ELECTRONICS Australia

HiFi, Radio & Computers

JUNE 1979

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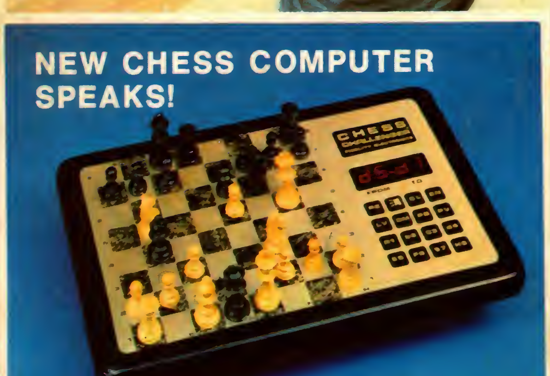
TYPEWRITER, CONTROL CENTRE FOR THE DISABLED



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HOW THEY TRIED TO KEEP THE "SKYLAB" SATELLITE IN ORBIT

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We could tell you about the astonishing transient response of the Kenwood amplifiers. And about their wonderfully clean low end response, free of phase distortion. About their remarkable clarity throughout the audible range.
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It's a whole new world of realism in music.

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ELECTRONICS Australia

VOL. 41 No. 3 JUNE, 1979

Australia's largest selling electronics & hi-fi magazine

America's Skylab will re-enter the Earth's atmosphere and crash sometime towards the end of this month; but only after an incredible battle by NASA to save the ailing space station. The story of this battle begins on page 10.

Give your home increased security with this space-age electronic combination lock. Full constructional details are on page 44.

On the cover

Called "Popstar", this typewriter has been specially designed for the disabled and can be operated using pressure pads, a joystick, or a suck/blow unit. For more information on Popstar, refer to page 4 of the February issue. Inset shows the new Voice Chess Challenger, the computer that plays chess and talks (see p5). Main picture courtesy British Information Service; inset courtesy Futuretronics Pty Ltd.

FEATURES

HIFI TOPICS AND REVIEWS

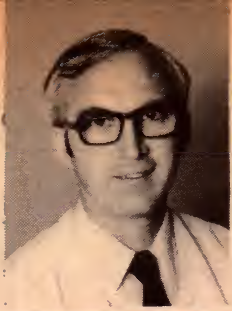
PROJECTS AND CIRCUITS

MICROCOMPUTERS

AMATEUR RADIO, CB SCENE, DX

COLUMNS

DEPARTMENTS



Editorial Viewpoint

A consumer's right: the circuit diagram

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I noted with interest this month that the Television and Electronic Services Association, representing many electronic service technicians and firms, has recommended to the Minister for Business and Consumer Affairs that it be made mandatory for a circuit diagram to be provided with all electronic equipment sold. The Association made the point that this would not only facilitate servicing of equipment currently very difficult to have repaired, but would also be likely to reduce servicing costs as a whole by reducing servicing time.

This seems to me such a sensible and worthwhile suggestion that it deserves the full support of everyone — not just those in the servicing industry, but all of us with electronic appliances and equipment.

It has long seemed to me incredible that all sorts of electronic equipment could be sold without even the most basic and essential servicing information: the circuit diagram. Having been involved in part-time servicing myself in the past, I know just how difficult it is to service equipment without this vital information.

Not that a circuit diagram provides all of the information needed for efficient servicing, by any means. But it is a tremendous improvement over having nothing, which is often the situation at present. This is particularly so when it comes to esoteric brands of imported domestic appliances, many specialised items of industrial and medical equipment, some amateur radio and CB gear, and quite a few personal microcomputers.

Of course, some suppliers will argue that servicing manuals are often available for much of this equipment, at least in theory. But most service people will tell you that even they find these manuals at times almost impossible to obtain. If they find it difficult, you can imagine how hard it would be for the average consumer. In any case, service manuals are generally regarded as an "optional extra", and can cost quite a few dollars.

It seems to me that consumers have a right to expect that any piece of equipment they buy comes complete with the basic information necessary to service it, as a matter of course. For electronic and electrical equipment this should mean a "captive" circuit diagram, at the very least.

In short, I think the TESA recommendation deserves the widest possible support. If you agree, why not write to the Minister yourself?

— Jamieson Rowe

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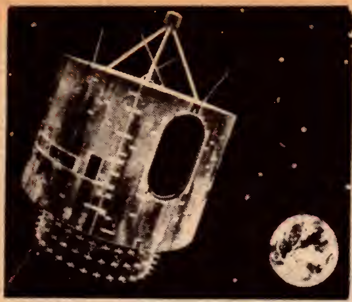


News Highlights

Squabble over satellite space

A conference which concluded in Sydney last April has laid ground rules for serious international politicking in September over a natural resource 36,000 kilometres in space.

by Ian Reinecke,
Australian Financial Review

The resource concerned is the geostationary satellite orbit, a fairly loosely defined strip of nothingness which encircles the earth above the equator.

It has assumed a significance greater than any other piece of space because it is along this tramline in the sky that "fixed" communications satellites travel. They remain in a position constant with the earth's surface as it revolves with the result that the ground stations to which they transmit need not have complex and expensive "tracking" facilities.

Like most other natural resources, the geostationary orbit is finite but is "worn out" only by the way it is used. Inefficient, unco-ordinated use of the orbit wears it out quicker than if it is managed by international agreement to minimise interference between satellites operating within it.

Mr E. Craig, assistant director, advanced techniques, for Telecom Australia, delivered a keynote address on management of the resource at the conference, jointly sponsored by the Australian Government. It is the final conference in a series of three regional meetings as a lead up to the International Telecommunications Union's World Administrative Radio Conference in Geneva in September.

Here, competing nations will seek to maintain access to the geostationary orbit, particularly the Third World countries. Their concern is the possibility of being blocked out of the resource by the satellites of the developed countries, which will multiply quickly as launch costs decline.

There is room within the orbit for a huge number of satellites but it becomes crowded when signals from different satellites interfere sufficiently with each other to cause problems.

Lexicon translator now in Aust!

Readers may recall that in the March issue we ran a news item on the Lexicon LK-3000 — a pocket-sized computer which can be used to translate languages. The device is now being imported into Australia by Hanimex Pty Ltd, and should be available in major department stores by the time this item appears.

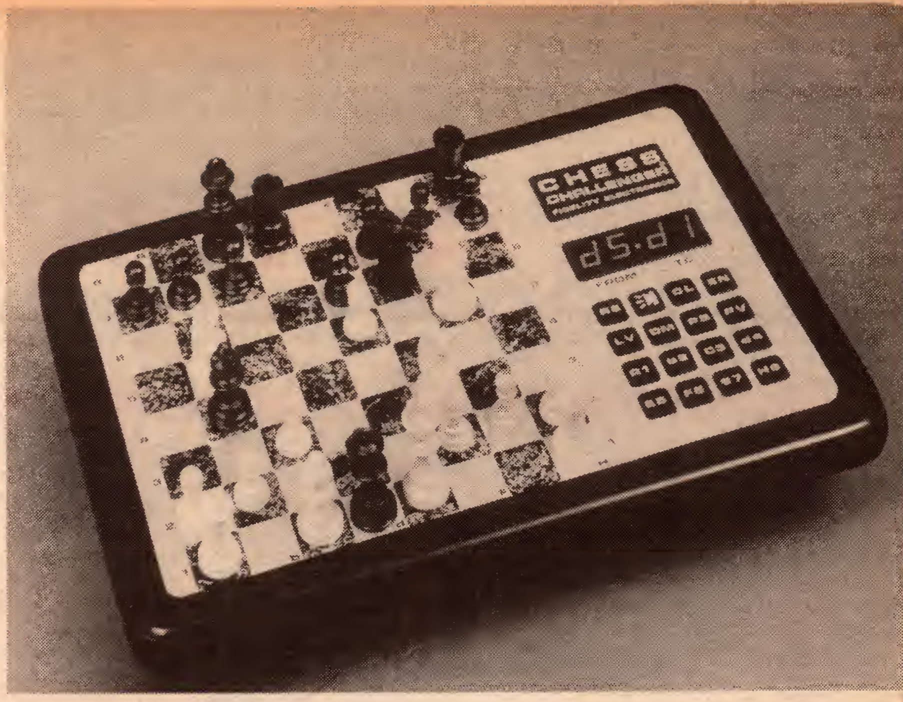
At last reports, the LK-3000 was rapidly earning a fortune for its inventor Anastatios Kyriakides, a young Greek migrant in the United States. The device, which looks like a pocket calculator, works by entering a message into the unit via the keyboard and pressing a button. Almost instantly, a translation of the sentence in a designated language appears across a red LED display.

The LK-3000 is programmed by plug-in modules that simply slot into the back of the keyboard and display assembly. Each module houses an 8-bit microcomputer and a 64k ROM which stores some 1500 words or phrases in both English and the language it is to translate.

Currently available modules are capable of translating English into Spanish, French, German, Italian, Polish, Portugese and phoentic Greek. Soon to come are Swedish and phonetic Russian and Japanese translation modules.

But the LK-3000 is more than just a language translator — it's a miniature computer terminal as well. The device will be used as the official hand-held translator for the 1980 Olympic Games in Moscow, and Lexicon will offer modules containing records and statistics of previous Olympic events.

Computer plays chess — and talks!



American manufacturer Fidelity Electronics Ltd has added a voice to its now famous Chess Challenger, a microprocessor based chess game. The new game is called "Voice Chess Challenger", and takes its place alongside the earlier Chess Challenger 7 and Chess Challenger 10 games.

Voice Chess Challenger is based on the Zilog Z80A CPU and is said to include the most powerful chess program ever placed in a microprocessor. Backing up the CPU are 8k bytes of ROM to store the game program and rules, another 4k bytes of ROM to store the voice program, and 1k bytes of RAM to store the positions of the chess pieces.

The voice program allows the latest in the Chess Challenger line to be used by the blind. Each move and capture is audibly read out, and the board positions can be audibly listed on demand. At the conclusion of the game, the computer displays the number of moves played.

The Voice Chess Challenger will be released in Australia on July 18 next, and will be available from Futuretronics Australia Pty Ltd, 79-81 Levanswell Road, Moorabbin 3189. Retail price will be $495.00.

NS announces record profit

National Semiconductor Corporation has announced a record third quarter for the 12 weeks of fiscal 1979, ended March 4th, 1979. Third quarter revenues totalled $165.3 million, up 49% over the same quarter of the prior year. Net earnings of $7.8 million or 59 cents per share were 50% ahead of the third quarter of Fiscal 1978.

For the 40-week fiscal year to date, revenues were $518.3 million and earnings were $24.6 million or $1.86 per share. For the same period of last year, revenues were $360.8 million and earnings totalled $16.2 million or $1.24 per share.

Switching transistors near 1000V barrier

Multiepitaxial Mesa technology, developed by SGS-Ates (Italy), has given rise to a new family of high voltage, high power NPN transistors. These are: BUW 34, 35 & 36 and BUW 44, 45 & 46 with VCBO (min) in the range of 500 to 900V and switching times of 0.2us typical. Other characteristics include VCEO(min) = 400-450V and a saturation voltage of 1.5V.

The new transistors should find ready application in switched mode power supplies.

New aid for the disabled

This prototype glove could overcome the almost insurmountable difficulties the inexperienced have in communicating with the deaf and mute.

Simple enough for a child to use, it comprises a left hand glove with the 26 letters of the Roman alphabet, numerals 0-9 and symbols such as question marks and pound signs printed on fingers, thumb and palm. The person would simply spell out words on the gloved hand.

The glove is the brainchild of Edinburgh architect Stuart Matthew, who has worked for many years with the disabled. He believes that it is the answer to the limitations that sign language and the standard deaf and dumb alphabet imposes on them.

NASA fuel research contract to UK

A British research team at Sheffield University has won a $136,000 grant from the US National Aeronautics and Space Administration (NASA) to study fuel combustion in high-altitude supersonic aircraft.

The 14-man team, headed by Dr Norman Chigier, will form part of a NASA research program into the effect supersonic planes have on the environment. Although the US has no civil supersonic aircraft, it does operate many military jets capable of flying at up to three times the speed of sound.

Dr Chigier's team has developed a technique which allows the size and velocity of individual droplets in liquid spray flames to be measured. This will enable the scientists to study the vaporisation of fuel droplets in the premixing chambers of gas engine combustors.

The team has also developed special computer facilities to process the information, and work is now under way on a new high-temperature wind tunnel.

NEWS HIGHLIGHTS

No danger from video terminals says Aust. Radiation Laboratory

Recently, there has been some conjecture over the possible emission of harmful radiation from Video Display Units (VDU) which are coming into wide use in Australian commerce and industry.

In Australia, the National Health and Medical Research Council and the Standards Association of Australia recommend that exposure rates to ionising radiation produced by equipment shall not exceed 0.5mR (millirotegen) per hour averaged over an area of $10cm^2$ at a distance of 5cm from any point on the external surface under all conditions.

Recently, the Australian Radiation Laboratory, together with some State Departments of Health, surveyed over 50 different types of VDU on the Australian market and evaluated them against the above requirement.

No single case has yet been encountered of a VDU which produced detectable amounts of X radiation, even though the lower limit of detection was as low as 0.01 to 0.05mR per hour. The laboratory concluded that, in the light of these results, the VDU does not constitute a public health risk.

World's first pocket typewriter

The world's first pocket typewriter has been invented by an American living in London. Mr Cy Endfield, who directed the 1964 film "Zulu", has been working on the machine for five years. He calls it the Microwriter.

Regarded as a potential replacement for the typewriter, the Microwriter has just 7 keys — 5 basic keys for the 5 fingers of the right hand, one key of control functions, and a capital shift key. Yet the machine can produce the Roman alphabet, as well as number and punctuation marks, and has full correction and editing capabilities.

The text is keyed in by pressing combinations of one or more buttons at a time, according to a code which has to be learnt. This code is said to be easy to learn, as Endfield has deliberately chosen combinations that are easy to remember. The letter "I" for example is formed by pressing the buttons under the thumb and index finger to resemble the vertical stroke.

Indeed, the inventor claims that, after three days training, the Microwriter is as fast as a normal typewriter!

As the text is keyed in, it is displayed — 12 characters at a time — on a 16-segment LED display. The text is stored in an 8K CMOS RAM (around 8 pages of typescript) and is controlled by an RCA Cosmac microprocessor. This information can be transferred to a regular audio cassette tape for additional storage while the writer continues his manuscript.

The machine itself does not produce words on paper. Instead, the unit is plugged into a high-speed printer which, on command from the Microwriter's keyboard, types the text at over 500 words per minute.

Vicom backs WIA for WARC '79

Vicom International Pty Ltd has donated $1000 to the WIA as a contribution to maintaining a WIA presence at the coming World Administrative Radio Conference. Photograph at left shows Russell Kelly VK3NT (Vicom Commercial Director) signing a cheque for presentation to Dr David Wardlaw, the WIA Federal President. Peter Williams VK3IZ (Vicom Technical Director) looks on.

Checkbook calculator

Available from National Semiconductor, the Datachecker checkbook calculator features three "permanent" memories, a calculator, and an 8-digit liquid crystal display. It allows users to maintain and update a checkbook balance, for example, and balances for any two selected charge accounts.

The calculator functions independently of the memory system. Two silver oxide batteries power the unit, and maintain the data in the memories even when the calculator is switched off.

Britain plans oil-from-coal plants

Britain is planning to build pilot plants to demonstrate two new processes for extracting petrol and chemical feedstocks from coal.

Under an agreement signed in London, the UK Government will contribute £800,000 ($1,448,000) and the National Coal Board £400,000 ($724,000) towards the cost of carrying out engineering design and feasibility studies. These will lead to a decision in 15 months' time on whether to go ahead with building the two demonstration plants.

The two oil-from-coal plants have been proposed by the National Coal Board and would each handle 25 tonnes a day. One plant would produce road transport and aviation fuels such as petrol, diesel fuel and kerosene by dissolving coal in a liquid solvent. The solution would then be processed through a hydrocracker in a similar way to natural crude oil.

In the second plant, it is proposed to use a high-pressure hot gas to produce a solution which is turned into such products as benzene and chemical feedstocks used in manufacturing plastics, rubber, artificial fibres and paint.

NEWS HIGHLIGHTS

Chrysler success in economy run

Many readers will remember that in the March 1979 issue we ran a story on Chrysler's "Electronic Lean Burn" (ELB) system. ELB is a form of electronic ignition that uses a computer to fire the spark in the combustion chamber at precisely the right moment.

The success of the system was recently demonstrated when a 4-litre Valiant equipped with ELB won the Award of Merit for achieving 30.23mpg in the Total Oil Economy Run. Second placing went to the V8 Holden Commodore with 23mpg, and third to the ELB Chrysler Regal Automatic with 25.34mpg.

The awards are based on an efficiency formula which takes account of weight, engine size, tyres, gear ratios and other factors.

The Valiant with the new fuel-saving ELB system achieved about 7mpg better than a non-ELB Valiant run in last year's event, an improvement of 30 per cent.

Consumer electronics show diversifies

Organisers of the Consumer Electronics Show have announced details of a substantially diversified show in 1979. The show will be staged at the Sydney Showgrounds from Wednesday, July 18 to Sunday, July 22.

Although previous shows have drawn wide support from the hifi industry, organisers this year are looking to a greater range of products to fully justify the "consumer electronics" title.

Amongst the projected list of displays are: digital watches and clocks, computer games, personal computing equipment, dictating machines, lighting equipment, records, amusement machines, antennas, PA systems, security systems, electronic calculators, microwave ovens, batteries, photo systems, professional sound recording equipment and radios.

For further information contact Riddell Exhibition Promotions Pty Ltd, 166 Albert Rd, South Melbourne 3205.

NBS signs accord with Soviet Academy

The US Department of Commerce's National Bureau of Standards (NBS) has signed a memorandum of cooperation with the Soviet Academy of Sciences.

The accord falls within the framework of the US-USSR Agreement on Cooperation in the Fields of Science and Technology, established in 1972. This marks the first time, however, that NBS has had its own cooperative arrangement with Soviet scientists.

The agreement provides for cooperation in the fields of thermal physics, thermodynamics, materials science, spectroscopy, chemistry, chemical kinetics, and cryogenic science. It also provides that "other fields may be additionally included by mutual agreement."

Viewdata goes public

The world's first public viewdata service is now in operation following the launch last March of the British Post Office's Prestel service. The service is initially only open to residents in London, but will later be extended to Birmingham, Manchester and Edinburgh, with full coverage of the entire country to follow.

Invented by the British Post Office, Prestel uses a combination of telephone and television to give viewers access to a central computer information bank. The range of information available is considerable. Immediately available at the touch of a button are: news, sports fixtures and results, share prices, weather reports, traffic information, house prices, restaurants, a car buyers' guide, entertainment guides, holiday information and train, shipping and airline timetables.

For relaxation, Prestel offers a variey of games and puzzles.

The introduction of Prestel established for Britain a substantial lead in the mass marketing of electronic information. The British Post Office has already sold the technology to the United States, West Germany, the Netherlands and Hong Kong, and is now engaged in sales discussions with a number of other countries.

Computer-aided design at Hendon

A new computer-aided design (CAD) system has been installed in the Integrated Circuit Facility at Philips Hendon Works in South Australia. The system, which is directly compatible with systems at Philips centres in Europe and elsewhere, give Australia immediate access to overseas microelectronics technology.

Philips says that the Hendon CAD installation will be used for the custom design of ICs and for circuit analysis. In addition, computation and analysis of test results from diffusion and production runs will be handled, and problem areas in hybrid design catered for.

The equipment installed by Philips includes a Systems Engineering Laboratories 32/55, a Tektronics 4014 graphics display unit, and a Calcomp 1039 plotter.

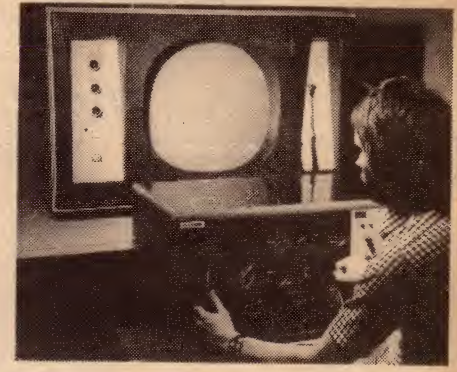
Low-cost flight simulator for clubs

This low-cost prototype aircraft landing simulator has been developed by the National Physical Laboratory in Britain. It could bring a realistic simulator for training student pilots in the critical landing phase of a flight well within the reach of small flying clubs.

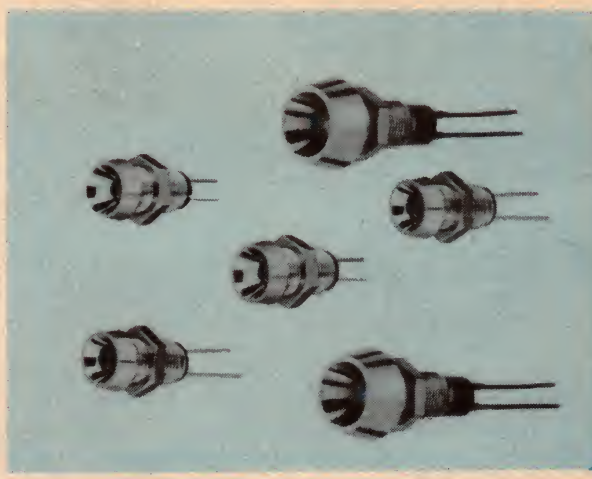
Called MALTA (microprocessor aircraft landing training aid) it is based on a microprocessor and comprises a graphic terminal and a control console. The display shows the parallelogram shape of an aircraft landing area as seen during the approach and shows how it alters as an imaginary craft descends. Both angle of descent and the size of the runway can be varied. For those who find the approach a bit too easy, cloud cover and strong wind speeds can be randomly generated.

The graphics terminal also indicates the horizon and has a readout showing the air speed, the vertical rate of climb, and descent and altitude. This expensive terminal will be replaced by a TV monitor in the commercial version of MALTA, to reduce its cost.

The control console is fitted as for a standard light aircraft, with instruments that include a stick or yoke control column, throttle control, flap control, air speed indicator, altimeter, vertical speed indicator, artificial horizon and glide slope indicator.



The Complete Colour Package in Swiss made miniature LED indicator lamps



Yes! Red, Yellow and Green and in 2 body styles

From SLOAN AG, Switzerland, these quality packed lamps are the ultimate in miniature perfection . . . nickel plated brass body, mirror finish reflectors and incorporating high surge voltage resistant Gallium Phosphide LEDs, all combined with C&K product compatibility.
Yes, these long life, competitively priced indicators are designed to blend with C&K panel dress nuts providing complete instrument panel uniformity and state-of-the-art design elegance. Employing the same size mounting holes as C&K subminiature toggle switches for both sizes, labour and tooling costs are minimised when coupled with C&K switches. The result . . . superb panel presentation from Swiss craftsmanship and C&K reputation . . . consider the advantages.

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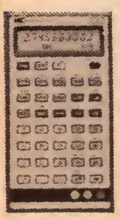

NATIONAL SEMI-CONDUCTOR NS108 $36 ($41) LCD, 50 functions, 850 hours battery. In Billfold style wallet, ideal keyboard layout.

CANON F41 $16.90 ($18.99) 22 functions

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HP 29C $162 ($181) Similar 33-E, continuous storage of 98 lines of program and 16 of 32 data registers.
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HP38-E $120 ($134) Advanced financial, programmable 8 to 99 lines, 7 to 20 data registers, built-in calendar.
HP 67 $450 ($501) Top model, programmable 224 lines, 26 data registers, magnetic cards.
HP 97 $750 ($835) Portable desk model of 67 with built-in printer, vast selection of programs available.

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For Ti59 and 58 — Lists, Traces, Prints Words (64 characters). Plots Graphs, etc.

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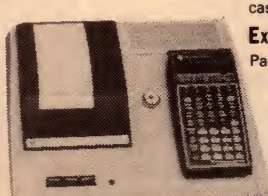

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A Ti58 and PC100A printer ~~$419~~ only $315 ($351)
(Also any extra modules ordered with package only $30 ea)

Ti59 ~~$328~~ ($245 ($274)
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Programs for mag. cards —
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- Programming Aids (Decoders and disassemblers) ● Securities
- Oil/gas energy ● Black body
- Printer utility

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- Ti58 ~~$141~~ $108 ($120) Programmable to 480 steps or 60 memories, otherwise same as Ti59 except for magnetic cards
- MBA ~~$82~~ $75 ($83)

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The Skylab story: a rescue effort that failed

Glinting in the sunlight, Skylab looms lopsided against the blackness of space. The solar wing at left lost its twin during launch. This head-on shot of the space station was taken in 1974 by the last Skylab crew before they returned to Earth. Four years later, Skylab's remaining solar arrays were still able to generate the power needed to stop its fatal fall.

by EDWARD EDELSON

When I interviewed NASA's Bill Peters at the Johnson Space Center on July 5 last year, we both thought that the long fight to save Skylab had been won.

We sat in a small office in Houston, just off the empty, echoing room that had housed Mission Control for the Apollo Moon flights. Step by step, Peters led me through the complex story of how he and a few other NASA specialists had awakened a spacecraft that had been sleeping for four years in the hostile emptiness of outer space.

They had scrounged equipment, made up rules to cover situations not found in any book, used a few scattered clues to diagnose what was happening more than 320km above the Earth, and invented techniques to handle unique problems. And they apparently had slowed Skylab's spiraling descent to Earth, putting the 85-tonne craft in an attitude that would reduce atmospheric drag and keep it aloft until the Space Shuttle arrives next year.

You couldn't exactly say they had accomplished the impossible. But you could say that they had done what no one had ever even tried to do before, and had done a few things that everyone said couldn't be done.

So while Peters wasn't relishing another one of the 18-hour work days that had become routine during the Skylab rescue effort, he had good reason to feel satisfied. On that steamy Houston morning, it seemed that only a few finishing touches remained before the effort could be marked down as a success.

Neither of us could know that the Skylab story was only just beginning. Before that week was over, almost all the gains that had been made so painstakingly since the rescue effort started in March 1978 were to vanish. Soon Skylab would go completely out of control again. Only some endless days of disciplined work would bring it back into line. Even as I write this, the ultimate end of the Skylab story is in doubt.

But if the July rescue project had failed, the end would have been certain: a fiery death as Skylab plunges back to Earth some time in 1979, scattering metal over an area up to 4,800km long and 160km wide. A few of those chunks could weigh more than two tonnes. If they should hit a city — which NASA says is extremely improbable — they could do serious damage.

It was the prospect of such a death for Skylab that sent Bill Peters and a few other NASA experts to Bermuda last March. Why Bermuda? If you understand that, you can better appreciate some of the factors that have made the Skylab story so peculiar.

NASA's Skylab space station is about to plunge back to Earth, scattering chunks of metal weighing up to two tonnes over a wide area. This is the story of how a handful of NASA men mounted an incredible battle to save the doomed space station, a battle that will shortly end in failure.

Improvised spacelab

To start with, Skylab was essentially a salvage operation — an attempt to keep the space program going in the face of funding cutbacks. The spacecraft is really an upper stage of a Saturn 5 rocket, one of the launch vehicles that was left over when NASA scrubbed some planned Moon missions because Congress slashed the budget. To make that upper stage into a living space that could support three-member crews in space for months on end NASA engineers used whatever equipment happened to be on hand. For example, a lot of Skylab's hardware — including its radio equipment — was built for use in the early '60s Gemini missions.

That was why Bill Peters and crew went to Bermuda. When Gemini was designed, NASA was using ultra-high-frequecy equipment for space communications. Later, the agency switched to microwave frequencies. Of NASA's 12 tracking stations only Bermuda and Madrid still had UHF capabilities. (Later, compatible equipment was installed at the Goldstone, Calif., station.)

That Skylab needed saving was in itself peculiar. Though the craft was plagued with troubles immediately after its launch it had successfully housed three crews. When the last astronaunts left the orbiting lab in February 1974, it was left in an orbit designed to keep it safely aloft until at least the early 1980s.

Enter, of all things, sunspots. Skylab — and every other spacecraft in Earth orbit — will come down sooner or later because of drag caused by the few wisps of atmosphere in what we usually think of as outer space. Sunspot activity has a direct effect on the thickness of the atmosphere out there. More sunspots mean that the Sun is spewing forth more of the matter and energy called the solar wind. That energy heats the atmosphere. As it is heated, it expands, and more gas molecules and ions from lower altitudes drift up. Density increases, and so does drag.

NASA's belief that Skylab was in a safe orbit was based on a relatively low estimate of solar activity in the 11-year sunspot cycle that began in 1976. Other experts predicted a higher level of sunspot activity and a shorter life for Skylab.

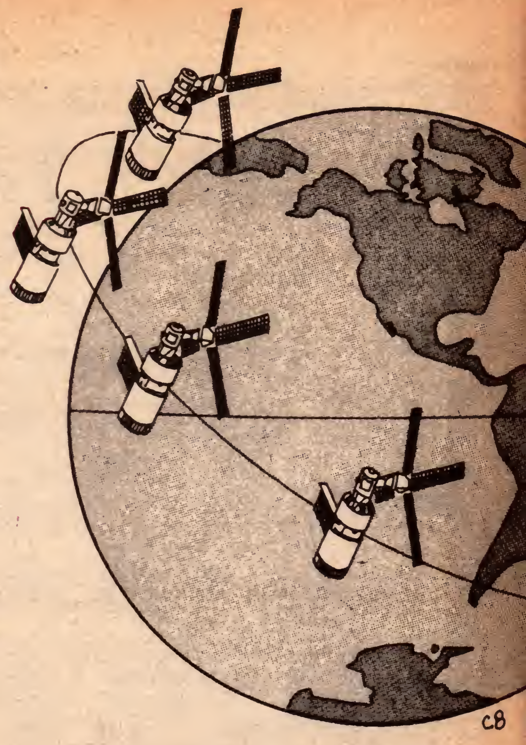
By late 1977, the North American Defense Command's (NORAD) satellite tracking system was telling NASA that Skylab probably would come down to Earth by the middle of 1979. It was bad news at a bad time because the space agency was starting to think of lots of things that Skylab could do when the Space Shuttle starts operating. The Shuttle, a reusable launch vehicle will be able to put boxcar-size payloads into orbit. Unfortunately, development of the Shuttle costs a lot of money, and Congress is still in a penny-pinching mood about space. So Skylab, a fully equipped house already in orbit, began to look more attractive to NASA.

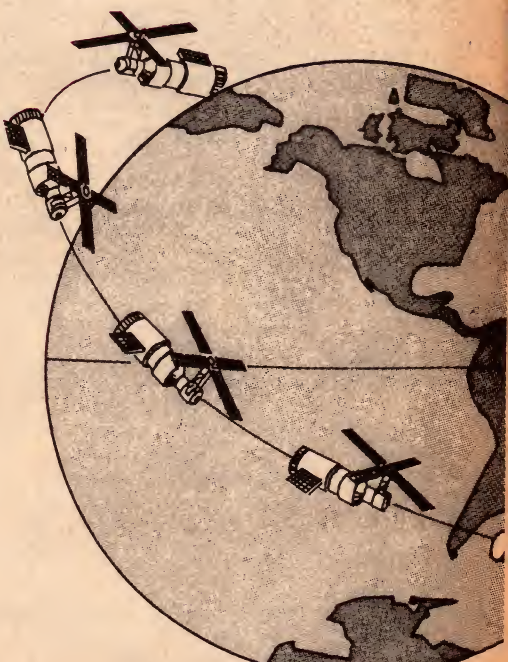
Plans developed quickly. NORAD had determined that Skylab was coming down faster than scheduled because it was in a highdrag attitude in orbit (see diagram). So a group of NASA experts would re-establish contact with the spacecraft, start its dormant control systems working again, and put it in the ideal minimum-drag attitude that would keep it up for a year or so until the Shuttle was ready. Meanwhile NASA contractors would build a $30-million gadget called the Tele-operator Retrieval System, a strap-on rocket system that the Shuttle would carry up to boost Skylab into a safe orbit.

For the rescue mission, NASA began assembling some of the old Skylab gang. Early in March, eight men — four from the Johnson Space Center, four from the Marshall Space Center — arrived at Cooper's Island, a NASA facility in Bermuda.

"The first thing we did was to establish that we could even communicate with Skylab," said Bill Peters, the head of the team. "There were all kinds of theories as to what would happen to a spacecraft that had been in space for over four years. We had to prove that we could talk to it and it could talk to us."

Communicating with Skylab wasn't something that could be done at leisure. For 13 hours a day, the spacecraft's orbit kept it completely out of range of the Bermuda station. For the other 11 hours, the station could contact Skylab once every 90-minute pass, when the spacecraft flew into the zone of coverage of the Bermuda antennas. On a good pass, when Skylab flew right through the middle of the zone, the station could keep contact for 11 minutes at most. On orbits when Skylab sideswiped the zone, the NASA





With its nose pointing 90 degrees away from its direction of flight (top), Skylab was flying perpendicular to its orbital plane — presenting its full length broadside to the thin atmosphere dragging it down. To compound the problem, the craft was performing a complex dance in space — both rolling rapidly on its axis and wobbling around in a wide, cone-shaped path. In its current end-on velocity-vector orbit (bottom), Skylab flies with minimum drag, its nose always headed in the direction of flight, and its solar panels always facing the Sun. To maintain this attitude, the craft must slowly rotate on its pitch axis once every orbital pass.

team would have to settle for as little as three minutes of communication.

Wake-up call to space

First contact came on the evening of March 6, 1978. It proved to be a microcosm of the Skylab rescue effort: unexpected success followed by a puzzling, mind-stretching problem.

Contact was made through the only two pieces of equipment the astronauts had left operational. They'd turned off everything in the Apollo Telescope Module (ATM), the tower perched atop Skylab's Docking Module or nose. Left on were two digital command systems in the Airlock Module (AM) — the section between the cylindrical craft's nose and the Orbital Workshop where the astronauts stayed. The AM contains the electrical control and distribution gear for the entire spacecraft.

The digital command systems receive messages and put them in proper form to run other instruments in Skylab. These two working instruments were hooked directly to the paddle-like solar array on one side of the spacecraft. That meant they could operate only when the solar cells were pointed at the Sun. (The AM's batteries were completely discharged.) "We had a 50-50 chance of the solar array being in the sunlight," said Peters. "We just happened to be in the right attitude."

A signal was sent to turn on the telemetry in the AM so that the NASA team could get information about the status of the various systems on board Skylab. When the first signal was sent, the telemetry went on and Skylab began transmitting data after four years of silence. The pens on the five strip-chart machines at the Bermuda station began recording the jagged lines that represented pressures and temperatures on Skylab.

Then trouble: The Skylab signal began to fluctuate. After two minutes, it stopped. When it came back on a few minutes later, the spacecraft's transmitter sent only the carrier frequency, not the modulation that carried information.

It took a while to figure that out. Finally, the NASA team arrived at an explanation. The transmission had stopped because the spacecraft was rolling much faster than they had thought. The solar cells had rolled out of sunlight, cutting off the electricity. (Later analysis showed that the rate of roll was more than one degree a second.) When the transmission returned, the signal was flawed because one of the spacecraft's three DC-to-DC converters, which provided the level voltage needed by the instruments, had failed.

The failure apparently was caused by the low, irregular voltage that the converter got as the solar cells rolled into and out of sunlight. To prevent another converter burnout, the team decided to charge four of the eight batteries in the AM. They instructed the spacecraft to use the power generated by the solar cells to charge the batteries — first a trickle charge to condition the nickel-cadmium batteries' electrolytes, then a full charge to bring the batteries up to their 33-amp-hour capacity. The men on the ground waited nearly three days while the batteries were charged, and the outcome was by no means a sure thing.

"There were theories that the solar panels could be severely degraded by having spent that long in space," Bill Peters said. There were also concerns about the condition of the batteries. As it turned out, there was very little degradation on the panels — so little that it could hardly be measured. And the batteries were almost as good as brand new. Explained Peters, "If you take a nickel-cadmium battery and discharge it completely for a long period of time, you apparently build up its capacity to store energy."

With the batteries fully charged, the AM's telemetry again turned on. This time nothing went wrong. With the AM transmitter sending good data on each pass, the NASA team started to bring the ATM, the other section of Skylab, back to life. This module is powered separately by its own X-shape array of solar cells.

The first step was simple: Close a relay between the AM and the ATM. This activated its receiver-decoder — equipment similar to the digital command system in the AM. On command, this equipment turned on the ATM's transmitter, which immediately began sending telemetry down to Bermuda.

There was a tougher challenge: recharging the ATM's 18 batteries. If you went by the book, it was impossible. The ATM's batteries were designed with a special circuit that would take each battery off line as soon as the voltage dropped below 27 volts. So if a small charge began trickling into the battery, the circuit would take it off line almost instantly. Given that circuit, it seemed that the batteries just couldn't be recharged.

The only glimmer of hope came from a malfunction: One of the ATM's batteries was working, even though it wasn't supposed to. Every time the solar cells rolled into sunlight, the battery put out power. So the NASA team began figuring out how they could do on purpose what one battery had done by accident.

Tricky trouble-shooting

They came up with an ingenious method based on the difference between "instantly" and "almost instantly." It seemed that the circuit took 10 milliseconds to shut down a battery. Someone figured out that by giving the battery many thousands of 10-millisecond pulses, they could build the voltage up to the magic 27-volt level.

It was a tedious task, but by this time the eight NASA men on Bermuda knew that it had to be done. When they had gone down there, they had thought that Skylab could be saved if they simply started it tumbling. The spacecraft was flying more or less broadside (see diagram), so that its drag was at a maximum. Tumbling the spacecraft should reduce the drag by half. But it turned out that a 50 percent reduction wasn't good enough. Skylab was coming down faster than had been thought. It would have to put into a minimum-drag orientation and held there, and that couldn't be done unless the ATM batteries were recharged.

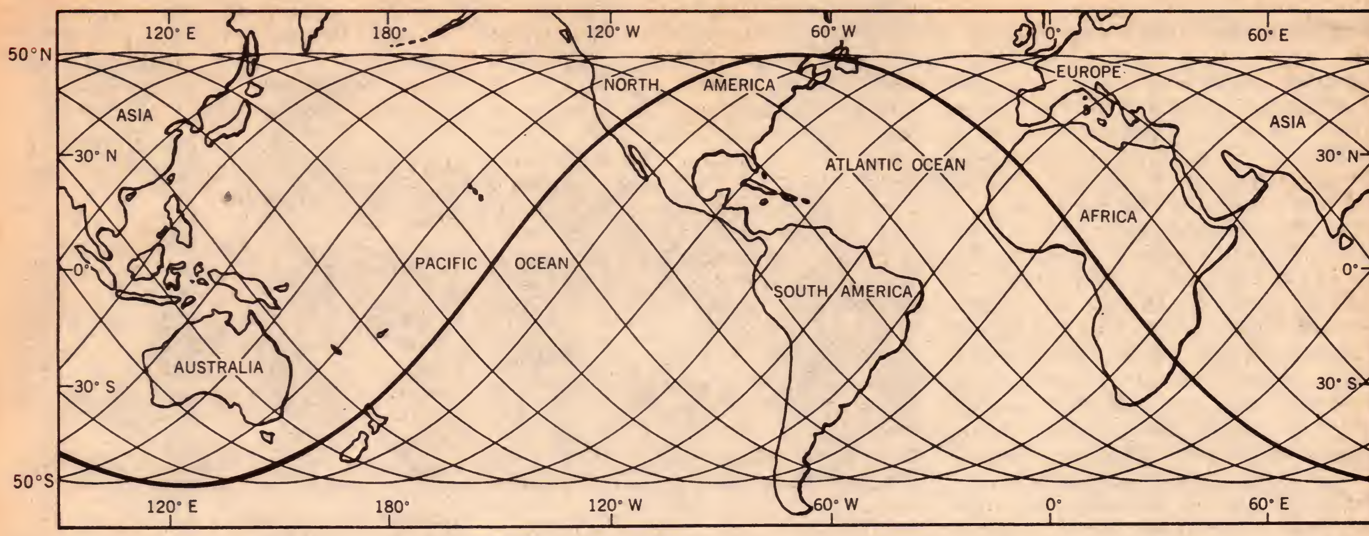
To do this, the NASA team had to return to home base. Before leaving Bermuda, they verified that the Skylab computer was operating. Then, for a month and more, the team hammered out and tested the procedures they would use to bring the spacecraft under complete control.

Herman Thomason, leader of the Marshall Space Center contingent did innumerable dry runs on simulation equipment there. In Houston, Bill Peters and his crew began building the control center that would carry out the actual procedures.

They used the bare room that had once housed the equipment that received data from instruments on the Moon. The room was available because money for monitoring the instruments had run out. The crew's equipment — a computer and some terminals, and a few cathode-ray tubes for displaying data — came out of storage or was switched from other assignments.

The technique used to give Skylab orders was equally improvised. The command sequence was anything but automated. By telephone, someone at Houston would order an operator at one of the three UHF tracking sites to load a three-digit command number in a Spacecraft Command Encoder. The operator would acknowledge the order over the telephone, then send the command to the digital command systems, which would in turn send it to the appropriate system on the spacecraft.

The Houston command center began operations on April 23, 1978. For more than a month, it did nothing but charge Skylab's batteries. It was a tedious operation. Every time Skylab came into radio range of one of the tracking stations, instructions would be sent at the maximum possible rate — two a second — to the two ATM receiver-decoders. Each instruction would put a



Skylab's angled flight path ranges 50 degrees above and below the equator. If the Earth didn't spin, Skylab would trace out the same path on every pass. Instead, the craft traces out a series of different passes, each orbit taking 90 minutes. A few possible paths are shown. It is almost impossible to predict where Skylab would crash if it should fall.

10-millisecond trickle of electricity from the solar panels into one battery. Over many days and with many thousands of instructions, battery voltage would slowly build toward the 27-volt level. When it reached that point, it would shoot up suddenly to full charge.

Four of the ATM battery systems were defective. By the end of May, the other 14 were fully charged, as were the eight AM batteries. That was just a prelude for the trickiest and riskiest part of the entire mission — the effort to put Skylab into a stable, low-drag attitude.

Complex command sequence

In theory it was simple. Skylab was flying belly forward, rolling once every five minutes and 40 seconds. The basic job was to move the spacecraft so that its Sun sensor, located in the middle of the X-shape solar-panel array, would lock onto the sun. To do that, Houston had to turn on three systems.

First, Houston had to start the two 400kg control moment gyros rotating. These regulate the craft's pitch, yaw, and roll. A third huge gyro had gone out of control during the manned mission, making the task of adjusting the spacecraft's attitude considerably more complicated.

Next, the team had to start the small rate gyros that sense the spacecraft's position. And finally, they had to turn on the computer that commands the attitude-control system of small, nitrogen-gas rocket thrusters.

But there were complications. While they were recharging the batteries, the NASA team found that Skylab was moving in an odd way. Not only was it rolling, but it also had a complicated wobble. Its wide end was moving in a bigger cone than the narrow end. This erratic wiggle would make locking on the Sun sensor even more difficult. In addition, all the equipment couldn't be turned on at once. Since the solar panels were rolling in and out of sunlight, full operation for more than a day would run down the batteries completely. The NASA team had to work with three constraints: the eight-hour period every day when Skylab was out of reach of any station; limited periods during the other 16 hours when the spacecraft could be contacted from the ground; and the even more limited time during those passes when the solar cells were in sunlight.

They worked out a sequence. Just before an eight-hour gap, the control gyros would be started. These take 12 hours to spin up to speed. When they were ready, the rate gyros and the computer would be turned on, at a time when the solar sensor was pointing toward the Sun. The sensor would be locked onto the Sun by computer instructions to the thrusters.

On June 8 the control gyros were turned on. On June 9 the rate gyros and the computer were turned on. Within a minute the sensor picked up the Sun and locked onto it. Some corrections were still necessary, because it developed that Skylab was tilted about 10 degrees from the Sun but those were accomplished over the next few hours.

A phantom command

Then came the first sign of real trouble. Before they closed out the day, the Houston team decided to send instructions that would let the backup computer take over in case of emergency. It was strictly routine, except for a Skylab switch selector that had developed a baffling habit of now and then sending two commands after receiving one order. In this case, the switch selector sent a signal that removed control of one of the gyros. The other gyro continued controlling, and its torque began twisting the spacecraft out of correct attitude. The computer sensed the error and used the nitrogen thrusters to bring Skylab back into line. It was a full orbit before the NASA controllers in Houston were able to correct the problem. By then the spacecraft had used up a lot of precious nitrogen — precious because it's needed to hold Skylab steady for docking with the Teleoperator Retrieval System.

Once that problem was corrected, the next task was to refine Skylab's orbit. Skylab was now in what Bill Peters calls a "solar-inertial attitude," meaning that its solar panels were always pointed at the Sun. In solar inertial, Skylab was still flying broadside about half the time. On June 11 a series of commands was sent that used the control gyros to put Skylab in an "end-on velocity vector," the minimum-drag orbit (see diagram).

It seemed that the mission was almost accomplished. One small chore remained. The Sun's apparent position relative to Skylab's orbit changes gradually through the year, moving first up to a maximum of about 72 degrees above the plane of the orbit and then back down to 72 degrees below the plane. Skylab had to be instructed to roll slowly so that its solar panels would keep facing the Sun. In every orbit, the computer and gyro instructions would have to be updated to correct for the change of about three degrees a day in the Sun's position.

Early in July, the Sun reached its maximum angle — and Skylab could not remain in end-on velocity vector. It was put back into solar-inertial attitude. When I interviewed Bill Peters, he was beginning what he hoped would be the

Saving Skylab . . .

last 18-hour workday of the mission, a day during which Skylab would be put back into end-on velocity vector. It seemed rather minor, the final finishing touch to a gruelling but successful operation that had rewritten the book on space missions. Apparently, Skylab's life had been extended for as long as a year, long enough for the Shuttle to get there. I packed up my notebook and headed back to write the story.

Then, early on Sunday, July 9, the phone woke Marshall's Herman Thomason from a sound sleep. "They told me they had lost contact with the vehicle," he said. "We came in and tried to regain attitude, but it had drifted so far out that we couldn't."

The basic cause of the trouble: Skylab required constant attention. First the NASA team had hoped that one set of instructions would keep Skylab in the proper attitude. Then they hoped that corrections every day or so would be enough. As it turned out, the position-sensing rate gyros do not function properly, so almost constant corrections for drift were needed. That means continual monitoring from the ground.

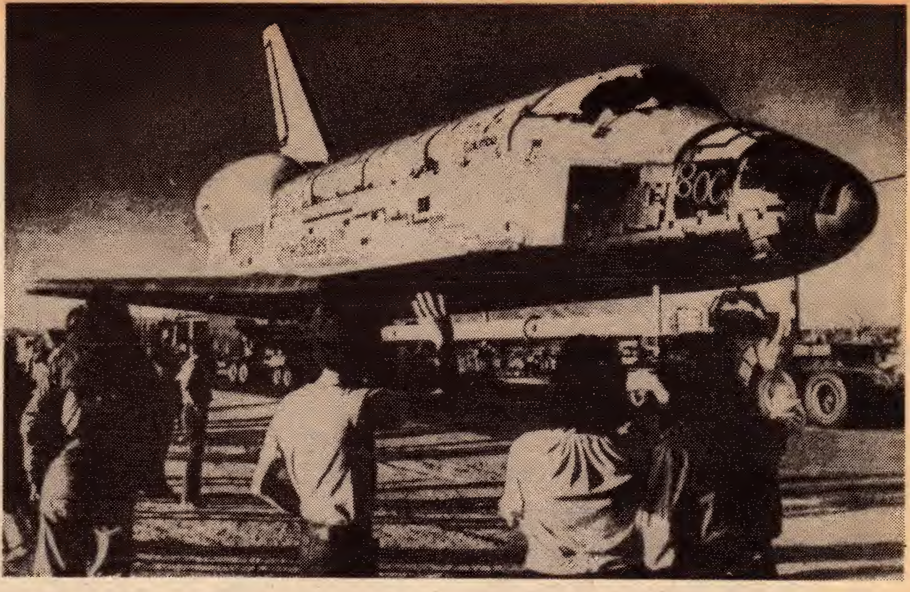
But the patchy ground coverage then available would not permit constant monitoring. At times, Skylab was out of contact for 20 hours — long enough for the errors to multiply fatally. The worst thing that can happen to Skylab is for its solar panels to drift away from the Sun, so that the spacecraft loses power. That was what happened. The ATM batteries began tripping off line, the computer's power source was cut off, and the spacecraft was once again out of control.

Back to square one

Again began the painstaking, tedious work of bringing the ATM batteries back on line by giving them thousands of 10-millisecond pulses. Again the tricky sequence of bringing the control gyros, the rate gyros, and the computer back on line so that Skylab could be put back into solar-inertial attitude. Again the effort of getting the Sun sensor to lock on the Sun. And all of this was done by exhausted men whose normal office day was 18 hours, with everything else in life — eating, sleeping, or whatever activity — crammed into the other six.

And to made life more interesting, one of the biggest X-ray solar flares ever observed erupted on July 11. The flare did not stop the Skylab rescue effort, but it was another ominious sign of high solar activity and a denser upper atmosphere.

On July 19 Skylab was put back into solar-inertial attitude. On July 25 the spacecraft was put back into end-on velocity vector, the minimum-drag attitude. "Right now it looks very good,"



The Space Shuttle will not arrive on time to save Skylab. Here spectators wave to the Shuttle Orbitor "Columbia" as it moves through the streets of Lancaster, California, en route to Edwards Air Force Base, and thence to Cape Kennedy.

"Several future factors will decide Skylab's fate. One is the level of sunspot activity. Another is the Space Shuttle schedule. A third is the ability of Skylab's systems to keep on working properly. None of the three looks particularly good".

Thomason said a week later.

But by this time Christopher Kraft, the head of the Johnson Space Center, had just about written Skylab off. "People are used to NASA accomplishing miracles, but maybe this is one miracle we can't pull off," Kraft said. "I don't think the odds are very good."

Several future factors will decide Skylab's fate. One is the level of sunspot activity. Another is the Space Shuttle schedule. A third is the ability of Skylab's systems to keep on working properly. None of the three looks particularly good.

Sunspot activity continues to be heavy. The Space Shuttle is having trouble with its engines, putting its timetable in doubt. Even if the Shuttle sticks to the timetable, the Skylab rescue mission must occur during the Shuttle's second test flight which is cutting things very fine. And then there is the antique hardware on Skylab to consider.

"If we can just keep our systems working . . ." Thomason said. "Some of that hardware was built for the Gemini program back in 1963, 1964. Those old systems were never designed for this. They've been very cooperative with us so far, but. . ."

Thomason and Peters and the other NASA controllers are still working to save Skylab. Some time last October, a tracking station in Santiago, Chile, joined the Skylab monitoring network, so that the network is now able to keep contact with the spacecraft for 24 hours a day. The NASA team has gone on a round-the-clock schedule from here to the end.

The end could come with the death of Skylab. Or it could come when the Shuttle arrives in time. At this stage of the game, all you can say is that the rescue team has given it one hell of an effort.

Epilogue

As this issue of "Electronics Australia" went to press, things looked bad for Skylab. Since the preceding story was written, Skylab's orbit has deteriorated to the point where NASA now says that the 87-tonne space giant should plunge back to Earth — in pieces — sometime between June 15 and July 2.

The most likely date, according to a recent NASA statement, is June 21.

Most of the space station will burn up from friction as it plunges through the atmosphere. But NASA estimates that 400 to 500 pieces will survive, scattering over a path 6,440km long and 160km wide.

Most pieces will be small, but there are two large chunks, each weighing about two tonnes, that are likely to make it to Earth intact. Experts believe that the chance of anyone being hit is less than the chance of being hit by a meteorite, because 75 percent of Skylab's orbit is over water and most of the rest is over open land.

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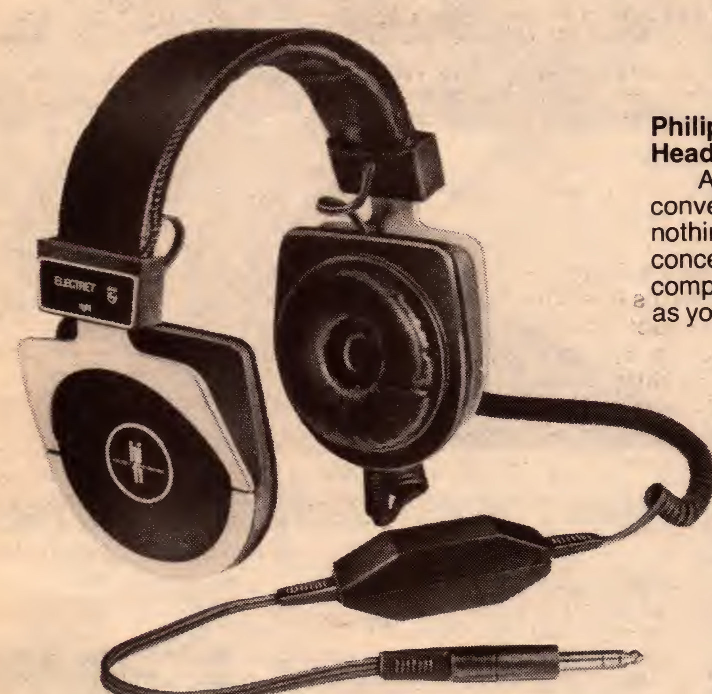

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Charles David Tandy

FROM A PAPER BOY TO A BILLION DOLLARS

1918-1978

Charles David Tandy, founder of the huge Radio Shack and Tandy chain of electronic stores, died recently at the age of 60. Just before his death, he had seen his Company's annual turnover nudge the billion dollar mark — no mean accomplishment for someone who, as a child, had experienced the rigours of the great depression.

by NEVILLE WILLIAMS

Charles Tandy's father, David L. Tandy, owned a small leatherwork store in Fort Worth, Texas and reject off-cuts helped supplement his schoolboy son's income from selling papers on the streets. Young Charles would teach his mates how to make leather belts and other knick-knacks — thereby "creating a demand" — and then supply them with the raw material they needed!

Some time later he got a real job — in the basement of a department store selling ladies shoes. In later life he would characteristically remark: "If you could sell ladies shoes, you could sell anything!"

He was sent to college on borrowed money and promptly rewarded his father by failing the course. But the experience taught Charles Tandy that, to succeed, he would have to work. And work he did, for the rest of his life!

In 1940 he graduated from the Texas Christian University, entered the Harvard Business School and, a year later, joined the U.S. Navy, serving as an officer for the remainder of World War II.

While in the Navy, he set a record for selling war bonds and it proved to be an indicator of what was to come: It sharpened his business sense and gave him a feel for large sums of money even if, at the time, it belonged to other people!

After the war, Charles Tandy returned to the family business in Fort Worth and set about to expand and diversify its activities. In the process, in 1963, he made a vital decision: to purchase "Radio Shack", a chain of nine retail stores in the Boston area, with a marker value of about $2,500,000.

Facing the new challenge, Tandy plotted a unique and deliberate course. Recognised giants of the American radio scene, like RCA and G.E. were turning away from retailing to concentrate on large scale manufacturing and distribution. Surely that would open the way for a specialist retail chain that could become known nationwide. The larger the chain, the greater would be its buying power and the keener its pricing.

The chain would bulk-buy, import, arrange manufacture, provide service and do whatever else was necessary but the emphasis would remain firmly on retail stores and the customer.

Since then, the 9 original stores have multipled and spread across America and overseas. At the last count, there was something like 4200 company owned stores handling Tandy brand products, plus nearly 3000 associated retail outlets. Corporation turnover has grown apace, to hit the billion dollar mark in the year ended June '78. For Charles Tandy, it was an ambition that was fulfilled right on target, at age 60.

But while the Tandy empire expanded worldwide, Charles Tandy's personal loyalties remained centred in the Fort Worth area and especially around his old university. It was no accident that the twin towers of the multimillion dollar Tandy Centre, commenced in 1975, served to revitalise the downtown area of Fort Worth, very close to where his father established the original leathework business. When the project is complete, it will have grown into a whole new business centre involving eight city blocks.

In retrospect, there is no doubt that the Tandy dream changed the face of radio marketing in America.

An editorial in the February issue of "CQ" magazine recalls the pre-1960 era, when amateurs were able to browse through any number of small, independant radio shops. The fashion, in those days was to build your own gear, and the multitude of shops made it easy.

But, in the late 1950's there was a downturn in this activity, with amateurs preferring commercial equipment and the number of parts suppliers diminishing rapidly. It is difficult to separate cause and effect, says "CQ" but the downward spiral was all too obvious.

CQ continues: "Mr Tandy, through Radio Shack, reversed that trend. Mr Tandy got us back to building again. With over 6000 radio stores available to the amateur, it is not surprising to find numerous articles in the amateur journals keying their parts lists to Radio Shack catalog numbers.

". . . Mr Tandy was not an amateur. He never worked DX . . . never climbed a tower nor strung a dipole. But he did bring the smell of solder back to the ham shack."

In Australia, the 180-odd Tandy stores and dealerships are not so directly involved with radio amateurs. They are much more concerned with hifi enthusiasts and the electronic hobbyist. It would certainly be true to say that the attraction and accessability of Tandy stores has provided the initiative for many hesitant handymen in Australia to have a go, and do it themselves!

One of Charles Tandy's major decisions, prior to his death, was to commit the Corporation to the development and promotion of a microcomputer intended expressly for small businesses and individual enthusiasts. Out of that came the TRS-80, which has already made its mark around the world in this new and burgeoning field.

In fact, it may well prove to be a whole new reach for the Tandy Empire. The TRS-80 is being supplemented by a whole range of peripherals and the Company is well advanced in its program to open no less than 50 specialised Radio Shack computer centres during the current year. Unfortunately, Charles Tandy did not live to see the result of what, at the time, must have been a quite far-sighted vision.

Interference-free data transmission

Optical fibres are rapidly coming into service in telecommunications systems and to distribute television programs. A new development is a system using optical fibres for interference-free telemetry, in which data inputs can be clipped onto the fibre without breaking into it, almost as simply as pegs are put onto a clothes-line.

by PROFESSOR D.E. DAVIES & DR B. CULSHAW

Optical fibres are thin strands of glass or silica (quartz) which can guide light over long distances. No thicker than a human hair, they can carry information if the light travelling along them is suitably coded, for instance, by on-off modulation of the light source. The attenuation of an optical fibre has fallen dramatically over the past five years from over 40dB/km (decibels per kilometre) to figures now typically in the region of 1dB/km.

People are mainly interested in optical fibres for public telephone networks. One of these tiny strands can carry thousands of telephone conversations while taking up only a very small space, so that theoretically the telephone administrations can considerably expand their facilities without having to lay new ducting under the streets. Because of this, optical-fibre technology is now one of the fastest growing fields in electronics.

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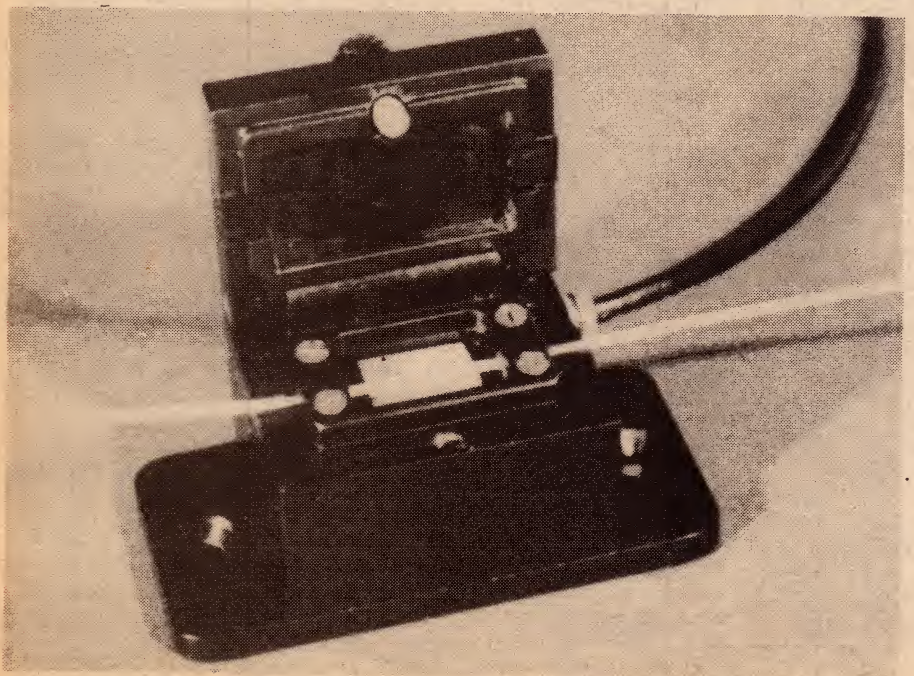
Optical fibres have several interesting properties when compared with conventional copper cables for transmitting information. A fibre does not radiate the signal it carries, nor is it affected by any local electromagnetic interference. So fibres may be freely used in areas of strong electromagnetic fields that might otherwise interfere.

This makes them useful for aircraft and satellites, too, where a great deal of copper cabling has hitherto been used to shield unwanted signals rather than to transmit information; here the fibres' light weight is another advantage. Because the fibre is an electrical insulator, it does away with expensive voltage and current transformers normally needed when coupling electrical measuring instruments to high-voltage power lines. Interference problems often caused by current flowing in 'earth loops', that is, closed circuits formed by a series of earthed conductors, are also avoided when fibres are used.

Hazards

An optical signal travelling along a fibre, though electromagnetic, does not cause a spark when exposed to the atmosphere through a chance break in the cable. This means that optical fibres can be used in hazardous areas, for instance, in chemical and petroleum plant, without risk of fire. Such fibres are a cheap means of communicating through areas where so-called 'intrinsically safe' equipment is normally called for,without degrading performance.

The information is usually passed along the fibre by modulating a light source; that is, by impressing intelligence on it. This is done by switching the source on and off in a binary code. The source itself may be a light-emitting diode (LED) or a laser. With the former, the light may be modulated only by changing its intensity. In the latter,we can still change the intensity but, because a laser is an optical equivalent of an ordinary radio transmitter (which means it is a 'coherent' or pure source), we can also put information on to an optical 'carrier' wave by varying its phase. The phase is the position of the wave in relation to its starting point. If we move all the peaks and zeros backwards or forwards along the direction in which the wave is travelling, usually by less than one wavelength, we have shifted the phase of the wave in sympathy with the information. This form of modula-



A typical transducer attached to an optical fibre. The ultrasonic pressure wave launched into the fibre imposes a linearly related phase change on the light wave passing along it.

tion can be decoded by a phase detector.

Being able to modulate the light by varying its phase has a number of interesting consequences which we will deal with in more detail later. But it is useful to point out at this stage that the phase of an optical signal passing along a fibre may be changed by altering the length of the fibre or the temperature, or by applying mechanical pressure to the fibre. So, if the fibre carries coherent light from a laser, it is important that the modulation and detection technique for the wanted information is insensitive to such physical or environmental changes. Conversely, we may measure the changes if the detection technique is made sensitive to the phase changes the cause.

Data Highways

These properties of optical fibres have led to a range of applications well beyond the original idea of using them for telephone work. Interest in optical-fibre information distribution systems is growing, and there is a plan for an optical-fibre communications network throughout a new city in Japan.

Communication and telemetry in many industrial and military applications involve the use of one-way or two-way 'data highways', which allow information to be fed in and/or received at a number of points simultaneously. A number of data highway systems now incorporate optical-fibres, but the components used in optical junctions cause considerable loss of signal strength; a loss in the region of 3dB (half the power) or more is typical. Even plugs and sockets can lose up to about 1dB. Moreover, because it is essential to break the optical path when introducing a new data signal, it is often necessary to regenerate a new data signal from the old one at each feed-in point.

The data is usually sent around the highway in the form of a synchronized binary signal, divided into time slots corresponding to the various data sources. The information is coded by the simple on/off technique, so the sources of light may be lasers or LEDs.

Phase Modulation

One exception to this general scheme of things is a unique form of data highway now being developed here. It offers simple, one-way telemetry from many sources to one destination, using a laser and exploiting phase modulation introduced in the fibre path by a pressure change on the fibre.

The laser used is highly coherent, with low noise. This means that the wave it produces is stable and very pure. At present we are using a gas laser, but developments in solid-state laser technology and improvements in the system will soon enable us to use a solid-state source. The output from the laser is fed into a length of multimode optical fibre, so-called because it has

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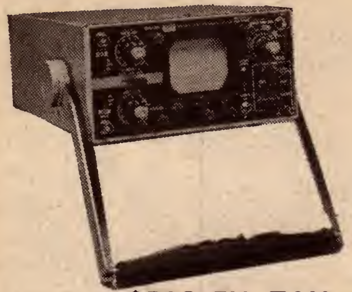

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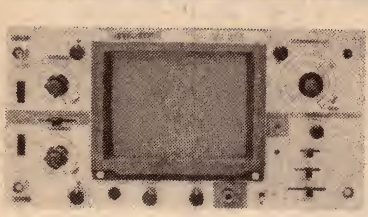

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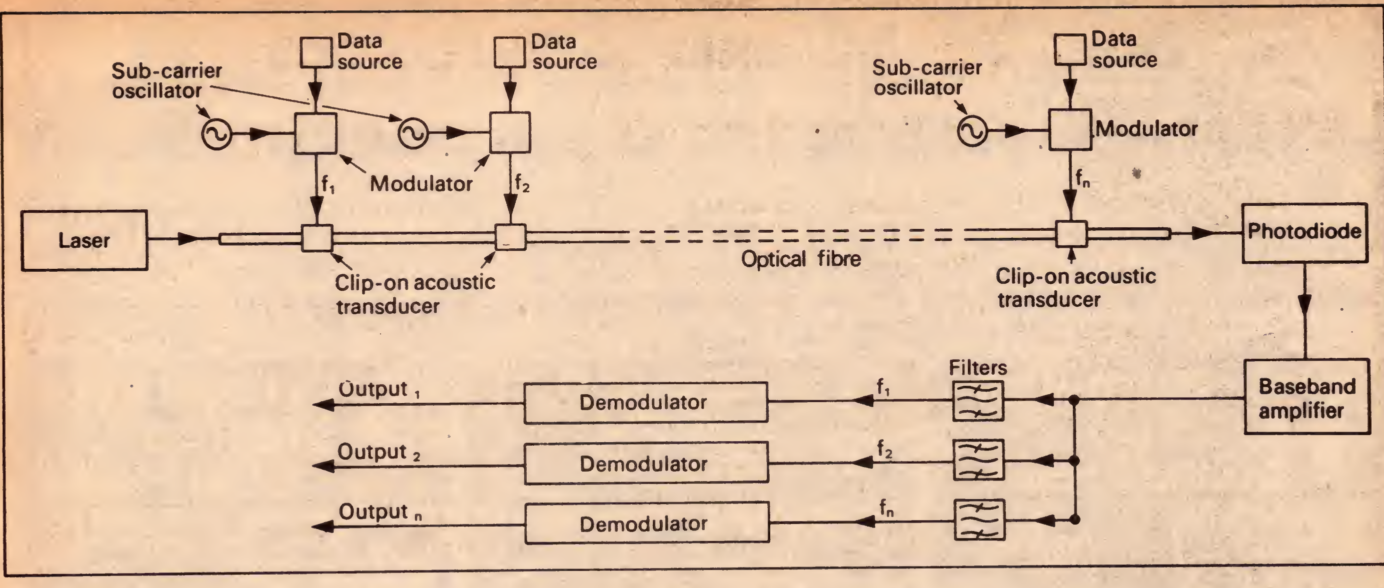

Simple one-way telemetry system from several sources to a single destination. Each modulator operates at a distinct frequency, the sum effect being a complex phase modulation of the laser-produced wave in the fibre. The receiving system uses filters to analyse the signal into individual components corresponding to the various data inputs.

numerous possible paths for the rays to travel from input to output, involving slightly different overall path lengths. Phase modulators are attached to the fibre at various input points.

Each modulator operates at a distinct frequency, known as the sub-carrier or centre frequency, and is keyed on and off in pulses representing the binary code of the data. Its output modulates the wave travelling in the fibre, by shifting its phase to and fro at a rate corresponding to the sub-carrier frequency. At any instant, the phase shifts introduced by all the modulators add together, thereby producing a complex overall phase modulation that can be analysed by receivers, at the data collection point, back into the components generated by the individual modulators. In this way data from individual modulators is identified and separated out.

Fading

In multimode fibres, the multipath propagation of the light causes interference between the rays arriving at a phase-sensitive detector, somewhat akin to the fading met with in shortwave radio communication, so we have to provide means of detecting the rays from the different paths separately and combining the outputs to give an acceptable level. Our team is now investigating a number of simpler, alternative systems for overcoming this problem.

Probably the most important advantage of the phase-modulated data highway is the fact that we can feed data into it wherever we like, without breaking into the optical path with a coupler. All we have to do is clip on the transducer, rather like putting a peg on a clothes line. That, and the low power needed, is what makes it so attractive for telemetry.

The phase modulation technique is particularly simple. An ultrasonic, piezoelectric transducer is attached to the fibre and energized at its resonant frequency with the required data signal. An ultrasonic pressure wave is thereby launched into the fibre and a phase change linearly related to the pressure changes is imposed on the light passing along the fibre. This means that we modulate the light in the fibre without breaking the optical path. So a single laser source and a single fibre with no direct connectors can provide access to a very large number of data sources and carry the data to a common reception point. The associated electronics system is simple, too, for there is no need to regenerate the entire data stream. The system is, of course, restricted to feeding only one receiving terminal.

Sensitive

Optical fibres are extremely sensitive to these changes of pressure. To find out how sensitive a fibre is, we can induce a phase change of the sort that might be expected from a change in the fibre temperature, or from a change in the strain or in the ambient pressure, by changing the physical length of the fibre, its refractive index or its diameter.

We may change one or more of these at a time, and if we measure the changes we can calculate the overall fibre sensitivity. Such calculations, supported by experiment, show that optical fibre is so sensitive that pressure variations a lot smaller than those caused by sound waves at the threshold of hearing are strong enough to give a detectable change in the optical output signal. This means that the fibres are highly microphonic; that is they are sensitive enough to pick up ambient noise, so the sub-carrier frequencies of the modulators must be well above the upper limit of the noise spectrum, which may be as high as 50kHz.

This extreme sensitivity gives the phase-modulated data highway an important advantage. It means that the ultrasonic power needed to modulate the light in the fibre is roughly proportional to the square of the bandwidth, or range of frequencies contained in the modulation. For many data signals, for example those from temperature flow rate sensors, the bandwidth is less than 1kHz. This means that the power needed for modulation is about 100uW (microwatts) and the power consumed by the electronic circuits to handle this is only in the milliwatt region.

So it is realistic to think of a data input station run by a battery that would have years of life. For equipment to sense data in hazardous areas, where the hardware has to be sealed in a box, without power leads, this is important. It is also an attractive feature where data has to be collected from a large number of sensors in, say, a pipeline system, where it is better not to have to distribute electrical power to the data input points. Moreover, because the optical fibres do not attenuate the signal heavily, a link could be several miles long.

We have already referred to the use of multimode fibres, in which the light follows numerous ray paths. The technique may also be used with single-mode fibre, where there is only one ray path, but such fibre is very small and the mechanical tolerances at the modulator and receiver are less than 1um (micrometre). Because of these tight tolerances, such a system is difficult to align optically, though it has the advantage of being electronically simple.

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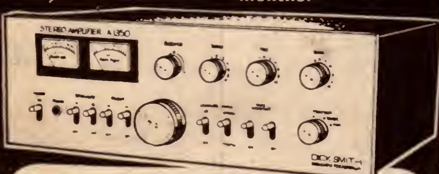

The super power amplifier from Dick Smith. A tremendous 55 watts RMS per channel into 8 ohms plus a truly superb array of controls. An outstanding feature of this amplifier is the midrange control a part of the audio spectrum ignored on most other amplifiers. The circuitry is direct coupled OCL and there are 37 transistors and 30 diodes PLUS a separate power supply for each channel for increased stability. Dimensions: 420(w)x150(h)x352(d)mm. Net weight 10.5kg.

A-1350

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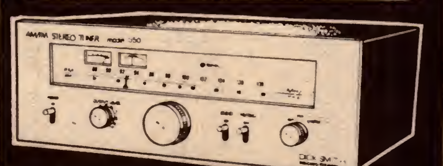
Top of the range AM/FM Stereo Tuner from Dick Smith. This unit has a superb performance coupled with complete user control. Muting of noise between FM stations, hi-blend of high frequency for a more mellow sound plus a control for setting output level. Excellent performance is maintained through the use of 1 FET, 1 stage RF amplifier, 3 gang variable capacitor, 5 stage limiter, PLL MPX, 9 transistors and 7 diodes. Dimensions: 420(w)x150(h)x352(d)mm.



A-1550

3 INTEGRATED STEREO AMPLIFIER

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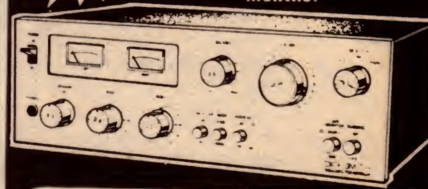

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A-1300

SAVE $124 — The basic system comprises the superb Dick Smith 55 watts RMS per channel amplifier (A-1350) PLUS the Garrard 125SB turntable (A-3070) PLUS the Playmaster 3/75LC speaker system (A-2364) — Reference 1, 6 and 7.
Normal separates price ~~$823~~ **$699** OR $70 dep. and less than $22 per month over 48 months.

SAVE $175 — Move up the scale and add the Dick Smith deluxe AM/FM stereo tuner (A-1550) to the basic system above. Reference 1, 2, 6 and 7.
~~$1062~~ **$887** OR $89 dep. and less than $28 per month over 48 months.

SAVE $211 — Top of the line system incorporates all of the above components PLUS the Dick Smith Dolby™ stereo cassette deck (A-3500). Reference 1, 2, 5, 6 and 7.
~~$1261~~ **$1050** OR $105 dep. and less than $33 per month over 48 months.

SAVE $104 — The second basic system incorporates the Dick Smith 30 watts RMS per channel stereo amplifier (A-1300) PLUS the Garrard 125SB turntable (A-3070) PLUS the Playmaster 3/53LC speaker system (A-2362). Reference 3, 6 and 8.
~~$703~~ **$599** OR $60 dep. and less than $19 per month over 48 months.

SAVE $143 — Take the basic system and add the matching Dick Smith AM/FM stereo tuner (A-1500) for increased performance. Reference 3, 4, 6 and 8.
~~$892~~ **$749** OR $75 dep. and less than $23 per month over 48 months.

SAVE $183 — Add the Dick Smith Dolby™ stereo cassette deck for a complete package. Reference 3, 4, 5, 6 and 8.
~~$1091~~ **$908** OR $91 dep. and less than $28 per month over 48 months.

DSE546

Forum

Conducted by Neville Williams

They're working on 3D films and TV — but don't hold your breath!

If you want to start an argument around the EA office, all you need do is to claim to have achieved 3D (3-dimension) viewing without the use of differential images for presentation to the respective eyes. Add a few more unlikely claims for good measure and you can expect a real babble of protesting voices!

The explanation for the above heading and introduction in a news item which was published a few weeks ago in the Sydney "Sun-Herald".

It stated that a commercial had been running on Australian television for some time which, unknown to the sponsor and to the viewing audience, had been shot in such a way that it had the potential to be viewed in 3D. The system was credited to Melbourne cameramen Vok Mol and Mike Browning, and was being promoted on a world-wide basis by the well known columnist, humourist and film maker Phillip Adams.

There was a hint of wider applications and reference to special substitute taking lenses, which could be fitted to any camera, movie or still. Mention was also made of special viewing glasses, but no hint of any means by which the system could record or present complementary left/right stereo images — the very core of any genuine 3D system.

In fact, it is difficult to envisage any commercially practical method whereby compatible, full colour, complementary stereo images can be presented on a normal television screen yet, by inference, this seemed to be the substance of the published claim.

There was more to follow: the report went on the state that the system could convert any existing colour film to 3D and any existing black and white film to colour and 3D as well. It could eliminate scratches, and such anomalies as a distant aeroplane which might appear in the sky when a period film was being shot.

The last couple of points raised no special queries because they could come within the ambit of modern video processing techniques. But 3D pictures without differential images and colour prints without colour information could scarcely escape the expected guffaws of ridicule from our technically orientated staff members.

Nor were we alone in this reaction. Various well informed people had also read the item and mentally rejected it along with other past claims by would-be inventors of no-hassle 3D. Their description of the news item tended to draw heavily on bovine imagery!

Behind such a reaction is a question of fundamentals, rather than mere technical bias or rigidity. Human stereoscopic vision relies on th fact that our eyes are separated by 7 or 8cm, so that each receives a slightly different version of the object or scene being viewed. The difference between the two images, along with various other clues, is processed by the brain to produce a subjective impression or judgment of distance.

Because of this, all genuine 3D systems of visual reproduction must start with appropriate complementary images, normally recorded from positions 7 or 8cm apart. Subsequently, these are presented separately to the appropriate eyes, using such devices as the old-fashioned stereoscope, selective red and green filters, polarised light filters, lenticular screens, prismatic overlays on postcards, etc. The methods have varied widely but they have all sought to satisfy the basic requirement of binocular presentation.

If by choice or necessity a scene or an object is photographed from one point only, there is no way in which the sole resulting image can be processed to produce a genuine differential counterpart as necessary for true 3D presentation. In short, there is no way in which photographic, or video, or computer technology can generate details that were never recorded in the first place.

Let me illustrate:

On the desk in front of me, at the moment, is a plastic tape dispenser. It is exactly in line with my left eye and, viewed along that axis, I can see only the front surface and, above it the top edge of the tape and the top inside-back surface. From that view, or a single photograph along that axis, there would be no way of man or machine telling whether the sides were gloss or matte, completely plain or embellished with a maker's brand or motif.

But, when I open my right eye, I can see along one side: it is plain, slightly convex, with no hint of a manufacturer's brand. But it is also glossy and carries a strong, distorted reflection of the page of type on which it is resting.

In short, my right eye is registering information that is just not available to the left eye.

If it is impossible to capture a true stereo image along a single axis, it is also impossible to recover one from an existing non-stereo single-axis print, be it in colour or black and white. The differential information is just not there. As in the case of my tape dispenser, it was obscured from the taking lens!

But having said all that, the news release in the Sun-Herald still had me intrigued. What had inspired it? Surely the people behind it were not totally ignorant of the foregoing and well known basics. So I began to back-track.

Although the unofficial test run of a "3D" commercial had been on Australian TV some of the information at least had reached the Sun-Herald newspaper via the New York Times — a curious and roundabout route.

But there was more to it than that. Another U.S. publication ("Television Digest", Jan 22, 1979) had carried a reference to the Australian involvement but credited the system primarily to Digital Optical Technology Systems (DOTS) of Amsterdam Netherlands. It

"I'll start enjoying Chaplin when they re-do him in 3D, wide screen colour and quadraphonic sound!"

was being further developed in America, they said, by the Ancom Company, drawing on the expertise of quite a string of technical people having previous association with companies like CBS and Fairchild.

From "Television Digest" as above, and other scattered clues, it would appear that the consortiums real objective is to increase the eye appeal of all forms of visual media. The possible application to movies and television made good headlines for the "Sun-Herald" but there is at least as much interest, if not more, in the area of home photography and printed matter. This last would add reason for the local involvement of Consolidated Press Holdings.

In trying to compose a technical whole from what rapidly became a jigsaw of bits and pieces, we were able to establish, with a fair degree of certainty, that the system did not use complementary images and was therefore not a true 3D system — despite the headlines. That requirement remains as difficult to meet, commercially, as it ever was.

The new effort is directed, rather, towards achieving what might better be described as "depth enhancement", by maximising what we referred to earlier as "other clues". At best, it is ersatz-3D.

It also became apparent that they consortium is not relying on a single key process, but a whole array of concepts and measures which combine towards the desired end result. Photographic techniques, optics, video technology, computer processing and human intervention are all involved at one stage or another.

From this point, we began to look at the options which might conceivably be open to anyone striving towards an impression of enhanced depth. How many of the available options we nominate and how many bullseyes we score remains to be seen! All we have to go on are technological and commercial "leaks".

As a starting point, reports on th DOTS system refer to the development of taking lenses which simply replace those fitted to a normal still, or movie or TV camera. The resulting image must undoubtedly be modified in some way, but it remains a single, full colour image, which may be printed, projected, and transmitted in the usual fashion without the viewer being necessarily aware that it has some special quality.

There is also talk of discrimination between in-focus and out-of-focus areas, and this suggests the first option: a sense of depth can be imparted to some pictures at least, by ensuring that the object of interest in the foreground is in sharp focus, with objects in the background in progressively "softer" focus.

The trick has been used by painters for centuries and by photographers for a shorter period. In the latter case, they take advantage of the limited depth of field exhibited by longer focal length lenses at full aperture. However, this can present practical difficulties and, if the photographer is forced by circumstances to settle for a shorter focal length and to stop down, he is faced with a much greater depth of field whether he wants it or not!

On this basis there may be times when a photographer — or a TV cameraman — might welcome some additional technological aid.

In fact, it is possible to conceive a range of special lenses in which the action of stopping-down would progressively block the centre of the elements, restricting light transmission to the perimeter. I gather from those who know about these things, that stopping down in this fashion would not add to the depth of field.

Option number one!

Another hint from the DOTS report suggested that the system involves some slight colour fringing. Technologists normally bend over backwards to avoid this but I gather that deliberate fringing is part of the DOTS technique: not enough to spoil the picture viewed normally, but sufficient to give a desired effect when using their "3D" glasses.

More about those in a moment.

If fringing is a requirment this, too, could be brought about in the lens by ensuring that its transmission properties varied slightly for light of different wave lengths. Whether or not this is inter-related with possible depth of field characteristics I wouldn't know, but it emerges as option number two!

One other option suggested by our Editor, Jim Rowe, is manipulation of the colour saturation in the defocussed background scene — something that may or may not be feasible, depending on circumstances.

Summing up all this, what emerges is a basic image — on paper, or on a TV or projection screen — which looks ordinary enough at first glance. But closer inspection may reveal emphasis on the in-focus and out-of-focus differential, slight but deliberate colour fringing, and possible reduction in the background colour saturation.

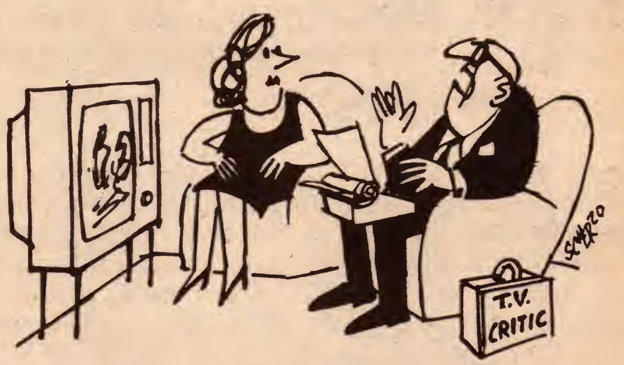
This under normal direct viewing.

Now where do the viewing glasses fit in ?

While following all this through, our Assitant Editor, Philip Watson, drew my attention to an article "The Amateur Scientist" by Jearl Walker in "Scientific American" (Dec. 1978, p. 182). The article is mainly a discussion of the old-fashioned stereoscope, but the author makes a number of interesting points:

While the pictures used are normally a genuine stereo pair, they are presented to the eyes in such a way that the eyes look straight ahead and at much the same focus as they would if looking at the original scene. These two factors strongly reinforce the stereo illusion, by assuring the brain that the scene is not printed on a card a few inches away but is much larger and much farther away: involving infinity focus and minimal declension of the eyes.

Walker declares that, for many people, the stereoscope still gives a credible illusion of depth with pictures other



"I'm sorry dear and I don't want to argue but, even if it was good, I wouldn't admit to liking it!" ("TV Times")

FORUM: 3D FILMS & TV — continued

than a theoretically ideal pair. It will even work, he says, with exact duplicates, if you fiddle their position a little!

The implication is obvious: distant focus and lack of convergence can become dominant clues, sufficient to give the viewer the sensation that he/she is viewing a distant scene rather than a close-up image. So convinced, the brain then invokes other clues — size, perspective, shadows, focus, saturation, etc — to assign depth to the total scene.

It is but one more step to add a prismatic effect to the stereoscope so that the eyes could view a single print instead of two identical prints, while still looking straight ahead and focussed to infinity.

Option number four!

But, having stated it, I am doubtful whether it would be a practical option, unless it proved possible to mass produce the glasses from plastic at minimal cost. Another difficulty would be that glasses intended for looking at photographic prints or magazine pictures at reading distance would have far too much convergence for, say, television viewing.

Then what about colour effects and hints that the DOTS viewing glasses employ red and green lenses?

This seemed to be totally anomalous, and a possible confusion with old time red/green stereo practice. One could hardly expect to get an adequate rendition of a colour image if viewed through two selective filters.

This led to the assumption that, while the filters may look nominally red and nominally green, they would have to be low pass and high pass filters, crossing over somewhere in the yellow region. Each eye would see half the spectrum, hopefully allowing the brain to integrate the two images into a full colour whole.

Here we find ourselves in unfamiliar physiological waters. Would the brain really behave this way? Everybody's brain?

And would it be sufficiently confused by the dissimilar images at each eye to stop insisting that the object being viewed was a single, flat image?

And what of the colour fringing, mentioned earlier. Through band-pass filters, each eye would see the fringing as a different outline. Could the brain be tricked into interpreting this as an actual displacement of certain parts of the image? As pseudo 3D?

May be it could. Maybe we've just added a couple more options.

So much for original picture taking and picture making. What about transforming an existing flat film into 3D, so called?

This need not add significantly to the mystery, in these days of highly sophisticated video and computer processing.

If the objective is to obtain greater contrast between in and out-of-focus areas, the print could conceivably be put through a video chain, with computer involvement, set up to soften the overall focus but to enhance electronically the sharpest outlines.

If the objective is to produce an element of colour fringing, it could probably be done optically with lenses or electronically in a video chain.

Other possible computer/video tricks might be to compare adjacent frames and instruct the system to process, in one way or another, anything that is moving. This, on the assumption that it is currently the centre of interest.

And so on and so on . . . optical and video skulduggery that may enhance the visual impact of an image. But in no way would it become true 3D!

A certain range of tricks could be pulled with black and white films but colouring them would be another matter. The fact is that a given tone of grey can be produced by that same weight of grey in the original scene or by an endless variety of hues, given the appropriate degree of saturation.

At most, a human operator might allot colours to the first frame in a scene and rely on computer/video technology to have those colours stay within moving outlines for as many successive frames as possible.

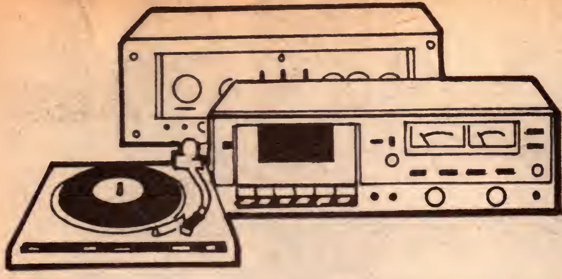
But, by the time one gets down to propositions like this — and more — they are beginning to sound like a patent specification; the kind of document where one lists all the things that might be accomplished, without being quite sure that they can be, or will ever be commercially practicable. How far the consortium will get with it is hard to say.

And, having said that, I must confess to a final let-down on the whole subject. At the end of three days of discussion and writing, I realised that I had fallen into the same trap as any number of others before me. The whole problem of 3D is so intriguing that one tends to pursue it avidly on the supposition that, if it could only be solved, the world would beat a path to one's door.

But all the indications are that the public is not up tight about 3D, even genuine 3D, and is certainly not keen to don glasses — especially a second pair! It's very much a ho-hum subject to the man or woman in the street.

Undoubtedly the DOTS consortium will continue to spend their money and have their fun but I seriously doubt that it will produce a revolution in our way of looking at things.

An occasional gimmick, maybe, but I would be surprised to see any more than that!



Hi Fi Topics

SEEING IS BELIEVING — ESPECIALLY WITH STYLI!

The use of a scanning electron microscope has enabled engineers of Stanton Magnetics Inc to verify or revise ideas about phono cartridge styli which had previously been based on supposition. They have also been able to make interesting observations on the effect of various groove cleaning methods.

by W. N. WILLIAMS

Stanton invested in their scanning electron microscope about four years ago, with the thought that it might assist towards a better understanding of stylus shapes and behaviour. It certainly did that and led, amongst other things, to the development of a curious saddle-shaped stylus which was capable of playing record stampers. Being the counterpart of a disc, the stylus had to ride on a ridge rather than in a groove!

An article on the saddle stylus was published in our August issue, last year, extracted from paper presented to the Audio Engineering Society (USA) by Stanton engineer George Alexandrovich. In a companion paper, the same Author summarised some of the other work then in train, using the SEM (a common contraction of scanning electron microscope).

More recently, an advertisement on page 26 of our March 1979 issue featured a microphotograph of a Stanton "Stereohedron" stylus tracking a record groove. While the printed illustration suffered by comparison with the original photograph, the excellent fit of stylus to groove was clearly evident.

In explaining the operation of Stanton's SEM, Alexandrovich says that it consists essentially of a viewing chamber, which is capable of being sealed and evacuated during use. On top of the chamber is a tube, in which an electron beam can be generated, focussed and deviated, more or less in the same way as the beam in a cathode-ray tube.

In use, a stylus or other object to be viewed is placed on a platform in the chamber, which is then evacuated. Five control knobs on the front of the instrument permit movement of the platform, during operation, to optimise viewing conditions.

When the finely focussed electron beam strikes the surface of the object, electrons are scattered but some are reflected towards a "scintillator". Here the incident electrons produce photons, which are detected by a photomultiplier, to provide an electrical signal.

In use, the electron beam is deflected so as to scan the surface of the object, in much the same manner as in a TV camera. The signal from the photomultiplier, varying according to the surface detail of the object, modulates the intensity of a second, synchronised beam, scanning a picture tube screen. The resulting image can be viewed or photographed as desired.

The effective magnification of the system depends on the ratio of the viewing screen size to the area of the object being scanned by the original beam. ((The ultimate resolution is largely dependant on how finely the object scanning beam can be focussed.)

According to Alexandrovich, one of the early and im-

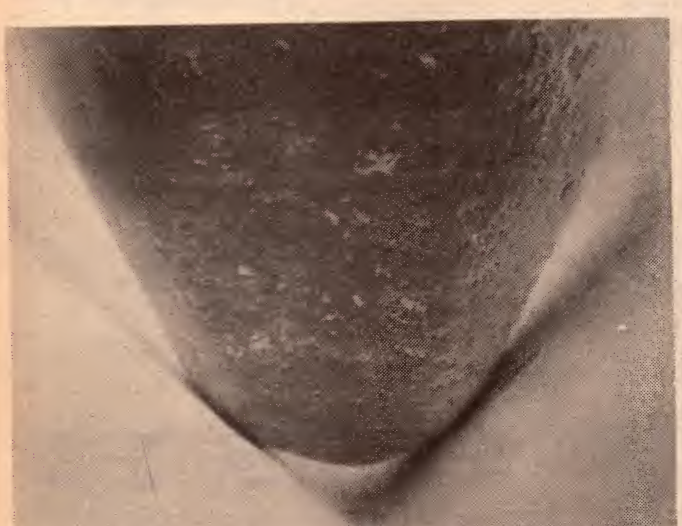


Fig. 1: A conventional spherical stylus having a tip radius of 0.7 mil resting in a groove. Note the limited contact area, which has to support the total playing weight.

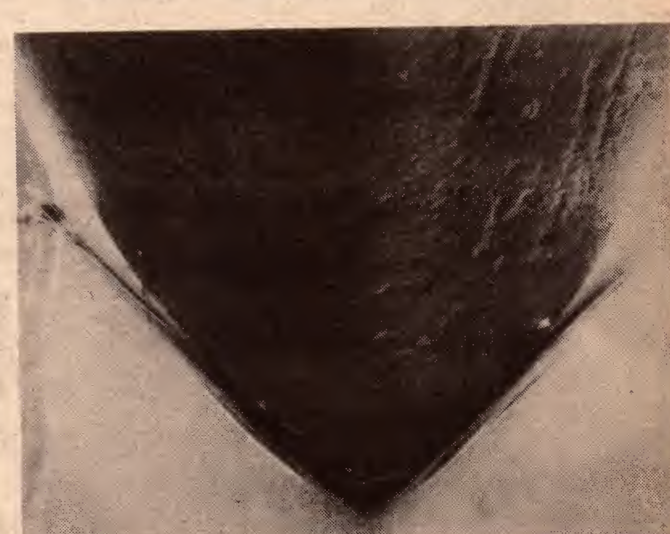


Fig. 2: A Stanton "quadrahedron" stylus resting in a similar groove. The weight is distributed along a vertical segment of each wall, causing less pressure per unit area.

portant discoveries made with the SEM was a method of observing and measuring the area of contact between a stylus and a groove. In fact, the technique emerged by accident.

In order to view electrically non-conductive materials like diamond, it is necessary to gold sputter the sample. The thin layer of gold on the surface serves a dual purpose: (1) it makes the sample conductive so that electrons from the constant bombardment do not build- up an electrostatic charge, thereby distorting or repelling the incident beam; (2) over and above this, gold reflects the electrons very efficiently, generating a strong image as a result.

However, the gold coating turned out to have another quite different use. In the very act of aligning a treated stylus in a groove segment for observation, Stanton engineers noted that the gold surface was scuffed off. It became immediately obvious that a gold coating could serve as a precise indicator of those areas which came into contact with the groove wall under various conditions. The position and the size of the scuffed area on the stylus could be assessed with a high degree of precision.

In pursuing this, the engineers discovered that, while some exotic shapes of styli gave commendable results when new, their contact areas changed drastically with progressive wear. in some cases the deterioration was such that they were producing greater groove wear and higher distortion than would be expected from a conventional spherical or elliptical stylus after the same number of playings.

Lengthy observations like this, combined with other listening and performance tests, led ultimately to the production of Stanton's own "Stereohedron" tip, as fitted to their top-ranking 881S cartridge. They claim that, not only does it exhibit the desired tracking capability, but it also retains the shape of its contact area for a longer period, thereby ensuring lower distortion, long-term, and lower record wear.

Another effect which was strikingly identified was that of skating force. When a record is being played by any conventional, pivotted pickup, the drag of the record on the stylus applies an oblique force which tends to pull the stylus inwards and against the inner wall of the groove. This accelerates wear of that particular wall and that particular side of the stylus. In addition, the imbalance of forces on the tip tends to increase the risk of mis-tracking, with increased distortion.

Alexandrovich says that they didn't have to look far to identify old discs which were worn assymetrically by having been played without skating force correction on the pickup arm. Nor was there any doubt that stylus life was shortened under these conditions. The lesson is therefore clear; make

Fig. 4: With properly adjusted anti-skating, wear on the stylus is symmetrical, ensuring maximum playing life. Note that, despite the wear, the tip is still clear of the groove bottom.

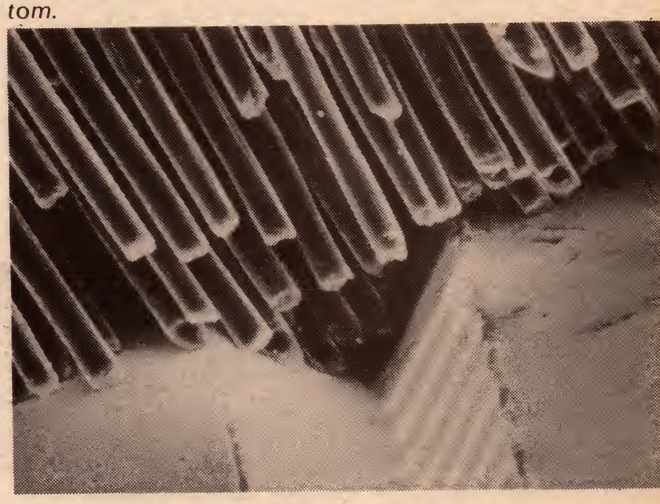


Fig. 5: Carbon fibres from a cleaning brush resting against the surface of a disc. Tests showed that they can dispel electrostatic charges but they are generally too soft to cope with anything but minimal lint and particle deposits. Fewer and thicker bristles under greater unit pressure are necessary to dislodge and pick up troublesome foreign matter.

Fig. 3: Loss of gold plating from the shoulders of a modern stylus indicates the area of groove contact. The tip has almost — but not quite — touched the bottom of the groove.

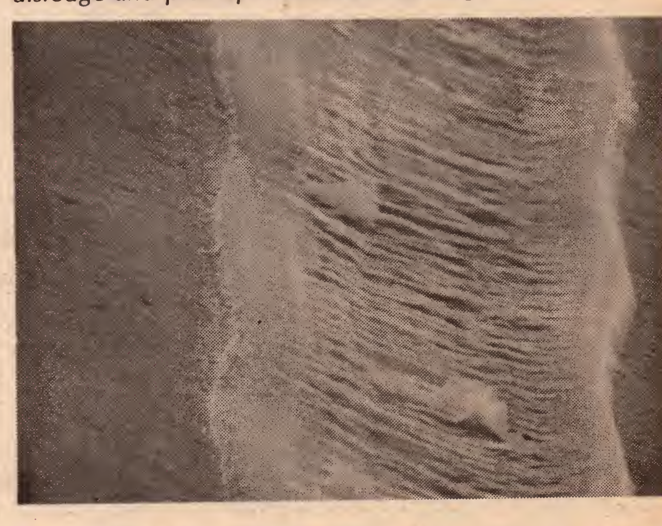


Fig. 6: A surprising observation was the effect of playing a disc when moistened with water. Far from lubricating the surface, it actually produces a tearing effect as shown.

sure that any record-player you buy has provision for skating force correction and use it as the manufacturer suggests. It isn't just a sales gimmick!

A side issue of anti-skating tests concerns those broadcasters and other professionals who "back-cue" — the practice of placing the stylus in a groove and spinning the record backwards to pick up the start of a musical item. The skating force is then outward and adds to anti-skating correction to place a heavy load on the outer groove wall and the outer shoulder of the stylus. If the practice must be followed, there is good reason to reduce or even eliminate the anti-skating provision.

Another area for investigation concerned various measures that are adopted against clicks and plops produced by foreign particles in the grooves. They looked at nylon brushes, velvet cleaners, brushes using carbon fibres, roller type dust collectors and so on. Concerning these, Alexandrovich says:

"To clean dirty records, one has to exert a certain amount of force to remove dirt particles clinging to the surface of the vinyl. From all record cleaning devices, those with thicker shorter bristles did a much better job of removing debris collected even at the bottom of the groove. Because there are fewer bristles, presure per bristle is even greater in this type of a cleaning brush and the job is done better. Combination of two types of bristles thick and thin, was advantageous for record cleaning before playing. Once the record has been cleaned and placed on the turntable, constant cleaning of the record with the brush attached to the cartridge or attached to the separate tone arm keeps the grooves clean.

"Devices using carbon fibers are too soft and if you divide the total force applied to the brush by the number of fibres, each fiber will exert pressure of less than 0.1 mg against the record surface. Needless to note, these devices are very good to remove any electrostatic charge when they are grounded but they do not remove nor attract dust like other ungrounded devices with heavier bristles.

"It is interesting to note that the brushes with thicker nylon fibers attract and collect dust as effectively as the thin fiber brushes. The action of such brushes is analogous to the moving magnet picking up iron filings and dragging a trail of them behind. Dust picked up electrostatically by the brush is dragged behind in a similar manner."

Last but not least, Alexandrovitch uncovered some fascinating evidence to do with the playing of discs when the surface had been deliberately wetted. An instinctive reaction would be to expect a reduction in groove wear because of lubrication of the surfaces.

In fact, the opposite appeared to be the case, with a thin film of water producing a quite unexpected deterioration of the vinyl in of the area of stylus contact.

The explanation appears to be that, under the pressure of a fast-moving stylus, the vinyl actually liquefies momentarily at the point of contact. The stylus therefore floats on this liquid film, which, of course, solidifies immediatedly afterwards.

The Author likens this to ice skating, where the metal blade does not really skate on ice at all, but on a very thin film of water, due to momentary melting of the ice. He points out that, if the temperature is too low for this to happen, one simply cannot skate!

Tests at Stanton Magnetics Inc. have shown a definite connection between ambient temperature and the tendency of the vinyl surface to tear under pressure at the point of stylus contact. It seems likely that the cooling effect of water on the groove surface prevents the vinyl from behaving in a liquid/elastic fashion, thus increasing rather than decreasing surface abrasion.

Otari MTR-90 24-track

Of considerable potential interest to professional recordists is this new Otari 24-track unit, "designed for the 1980's" but currently available in Australia. Using standard 2-inch tape, it can operate at either 15 or 30ips, and with spools up to 14in diameter. The main capstan operates without a pinch roller from a direct-drive motor, servo controlled, to provide stepless speed variation within plus and minus 20%. The percentage figure is indicated on a digital display. Three other motors are included, two for spooling and one to operate the head shield. The heads themselves are mounted on plug-in blocks with easy access for azimuth adjustment. The MTR-90 has a range of operating facilities and performance specifications appropriate to the professional market. It is also available in a straight 16-track version, or in a hybrid version fitted for immediate 16-track use but pre-wired for easy conversion to 24-track. For further information, contact Klarion Enterprises Pty Ltd, 63 Kingsway, South Melbourne 3205.

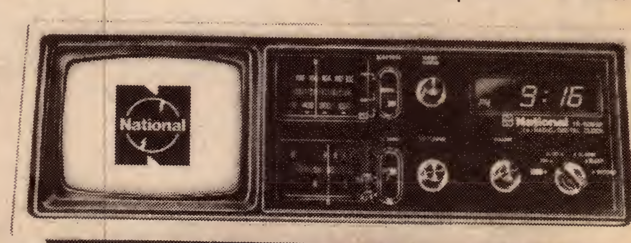
A new wow and flutter meter announced by Philips makes it possible for service technicians to check the performance of both video and audio cassette recorders, as well as phono turntables. Identified as type PM 6307, it can display drift and flutter on a pair of analog meters, each in 3 ranges and calibrated to 3%. Measurements can be made to DIN standard 45507 and a DIN socket on the front makes for easy connection to many of the units likely to be tested. It is possible to differentiate between mechanical and electrical faults. For further information: B. W. Druery, 15 Blue St, North Sydney. Tel: (02) 922 01081 Ext 246.

FERRIS: 45+45 FM AND TAPE STEREO FOR CARS

Called the MOFI — presumably a contraction of Motor-Fi — a new Ferris release comprises an FM/stereo tuner and an auto-eject cassette deck, plus a 45W per channel amplifier. Features include FM muting, S-meter, loudness control, bass and treble controls, and automatic play on the cassette deck. In this class of equipment, the MOFI is competitively priced at $469. A range of loudspeaker systems to suit the MOFI are available from Ferris as additional items. For information: Mr J. J. Manneken, Ferris Audio Products, 42 Grantham St, West Brunswick, Vic 3055.

AMPEX Vice President G. J. Ziadeh, also general manager of the company's tape division, visited the Sydney plant recently. He revealed that the Ampex Corporation had developed their own version of the new metal particle tape which offered a saturation capability 10dB higher than normal gamma-ferric tapes at the top end, and 5dB better than the high-bias formulations. It will be offered first in audio cassettes but may not be freely available on the Australian market for another 12 to 18 months.

ALTAIR POWER ATTENUATOR. Incredible as it may seem, electronic musicians say that they prefer the sound of an overloaded output stage to the "fuzzbox" overload involving an input stage. The problem is that, even for them, the noise level from a powerful system at overload level is often too great. So Altair in America have produced their PW-5 "Power Attenuator". It connects between the amplifier and loudspeaker system and can be set to produce attenuation levels in 4dB steps from 4dB to 44dB. This lets the musicians enjoy the overload sound they prefer, without exceeding the desired (or legal) sound pressure levels.



A most attractive item for bedside use is this new National Panasonic TR-5020A which combines a 13cm monochrome TV receiver with an AM/FM radio and digital clock. It has provision for a 60-minute automatic switch-off for the TV receiver — a "doze" switch — and an "alarm" function which can turn on the TV or radio at any preset time. The cabinet has a woodgrain finish. The TR502A should be available through a wide range of retail outlets at an RRP of $245.00.

ZEPHYR PRODUCTS of 70 Batesford Rd, Chadstone 3148 advise that their well established 100EXR and 200EXR amplifiers have been replaced with new models designated as 2100 and 2200. Included now are protective relay circuits and LED displays which indicate watts output in terms of either 4 or 8-ohm loads. In addition, they have a new line of New Zealand made Perreaux equipment including a no-frills preamplifier model SP-50 and an 80W per channel integrated amplifier model SA80B. They draw on the same basic circuitry as the EXR series but with fewer facilities and at reduced cost.

METAL PARTICLE TAPE standards have reached the tenative agreement stage, following a conference of the Electronics Industry Association of Japan (EIAJ). By common consent, member companies have agreed not to talk about the technical details but final agreement is expected at the next meeting, followed by publication of the standards shortly afterwards. That could be anytime from now on.

3M AUSTRALIA PTY LTD are making available to technicians a "Wollensak" brand cassette recorder alignment kit, similar to those used in their American factory. The kit includes cassettes for: 1kHz reference level; 8kHz azimuth; 10kHz azimuth; 3kHz flutter (all these are full track); head alignment gauge; Wollensak/3M torque cassette. The boxed kit costs $150 and is indented from America as required. Inquiries: Mincom Division, 3M Australia Pty Ltd, 950 Pacific Highway, Pymble NSW 2073. Telephone (02) 498 0033.

PIONEER ELECTRONICS AUST PTY LTD are offering a new tone arm, the PA-5000, which should interest those who are fitting up a playing deck with separate motor and arm. The arm has all the characteristics expected of a top quality unit but also features a dynamic brake which is intended to flatten the "Q" of any resonance formed between arm and cartridge in the subsonic region. As a further step, it uses a magnesium alloy headshell, which combines very light weight with a carefully designed content of rigidity and internal loss. Tracking force can be adjusted in units of 50mg, height is adjustable, as also is the anti-skating force, which involves a modified method of application. While the new arm can be considered with any motor and deck, Pioneer say that it mates logically with their PLC-590 "armless" turntable and their PC-600 moving magnet stereo cartridge. Price of the arm alone is quoted as $239. (Pioneer Electronics Australia Pty Ltd, 178-184 Boundary Rd, Braeside, Vic 3195. Tel. (03) 90 9011).

HIFI SHOWS IN FOUR CAPITALS

As indicated in our last issue, this month will see the first of four major hifi shows, each running from 12.00 noon to 10.00pm on Friday, 10.00am to 10.00pm on Saturday and 10.00am to 6.00pm on Sunday. Commencing dates are: June 22 at the Sydney Chevron; July 27 at the Brisbane Park Royal Motor Inn; September 7 at the Melbourne Southern Cross Hotel; September 14 at the Adelaide Town House. (See advertisement elsewhere in this issue.)

Hundreds of hifi systems and components will be on show, including less widely advertised brands. At left: the Hadcock GH228 Super Arm. Below: The STD 305D turntable.

Admission in all cases is free. As an additional attraction, those attending the shows will have the opportunity to win a complete Yamaha stereo system comprising a YP-D8 turntable, NS-69011 loudspeakers, CA-810 amplifier, TC-720 cassette deck, CT-810 tuner and YH-1000 headphones.

A very wide range of hifi products will be on show at all venues. Among the high budget items listed for likely showing is the Naim NAP250/NAC pre/power amplifiers, rated to deliver 70W RMS per channel from 20Hz to 20kHz with a THD of .001%. The price is listed at $3040.00. From there, systems and components range all the way down to the "under $100" group, with Akai offering their HC 550 cleaning kit for tape heads and rollers for a modest $5.95!

AUDIO TALK

by LEO SIMPSON

Rumble — a problem of measurement

Ever wonder why we do not quote specific figures for rumble when we do turntable reviews? The reason is that the rumble of modern belt-drive and direct-drive turntables is so low that it is difficult, if not impossible, to measure.

Typical records bought over the counter may have considerable more rumble content than the turntable you use to play them, although only the dedicated hifi enthusiast may notice it. This rumble on records takes several forms. The first and perhaps most easily identifiable, is recorded rumble, ie, rumble appearing on the original master tapes.

Recorded rumble such as this may be due to a number of sources at the site of recording. It may be due to seismic disturbance such as traffic noise and underground railways. Closer to hand, it may be due to noise from elevators or other heavy machinery vibration in the same building as the studio. Most (but not all) studios would be reasonably well isolated from these sources of low frequency vibration, but they can still show up on recordings.

Further down the recording chain, the rumble may be induced into the record at the master cutting stage. Inevitably, quality standards vary from company to company, so that some recording lathes will have more bearing rumble than others.

More rumble is introduced at the pressing stage. Called "pressing rumble" (what else?) this is inherent in the way the vinyl flows into the tightly constricted space between the two steam'heated platens. The way the plastic flows and subsequently cools inevitably places a more or less random rumble "imprint" on each disc pressing.

Before readers become concerned at the degrading effects of all this rumble, let me state that none of these effects is audible during normal listening. Where it might become audible is during critical listening with loudspeakers or headphones having an extended bass response and with volume levels high. Even then the rumble is only likely to be noticeable during quiet passages.

Now that you have all resolved to listen out for this defect, I will tell you how to distinguish some of the rumble. Recorded rumble present on master tapes will not be present during the lead-in and lead-out grooves, or between tracks. The same can be said of tape hiss. Any other rumble present in the system is due to the recording lathe used to make the master, pressing rumble or (horror of horrors) your own treasured turntable.

How do you tell if the rumble is predominantly due to the turntable? Well have a critical listen to a variety of records, preferably using good quality headphones. This enables you to block out extraneous ambient noise, assuming the headphones have good acoustic isolation. Secondly, headphones avoid confusing the issue with low frequency acoustic feedback.

Having listened critically to a number of records you should find that the rumble content varies from record to record and even from track to track. But if the rumble appears to be constant in tenor then perhaps it is predominantly due to your turntable.

Before concluding the worst about your turntable, it is wise to look further. Have a listen to the system with the stylus on the record but the platter stationary. In all likelihood, this may indicate that the supposed rumble is coming from the amplifier on the same shelf or in the same cabinet (transformer vibration). Or perhaps it is due to the air pump for your fish-tank, the fan for the oil heater or your next-door neighbour's air-conditioner.

What a can of worms we have opened here! At least, if you do find that "rumble" in your system is originating from other sources, you can try improving the acoustic isolation of your turntable. Some turntables have much better acoustic isolation than others. But if you think the problems of totally eliminating rumble in domestic situation are difficult, consider the problems of making accurate measurements in the laboratory

situation.

Even when I have made allowances for all these external sources of rumble and have achieved a system measurement signal-to-noise ratio of around 70 to 80dB with respect to a 10 millivolt signal, there is still a problem. Where do you get a source of quiet, unmodulated grooves? Test records are immediately suspect — they are just as prone to rumble as ordinary records, although they are probably subject to better quality control.

So most test record pressings can be regarded with a jaundiced eye, as far as rumble testing is concerned — although possibly some discs are quite good in this respect. We use an acetate disc which has been selected for a high degree of flatness and cut on a very well maintained recording lathe. Is it completely free of rumble? To that I must answer, "I dunno".

There is no reason to believe that even the best recording lathes have appreciably less rumble than the best turntables. So there is "even less" reason to believe that the rumble on our acetate disc is at least 10dB less than the rumble on one of today's excellent turntables. This condition has to be met before we can quote a rumble measurement which means anything.

Some readers may ask, "Well, why not test the turntable using a recording blank, with no grooves in it, at all?". Alas, that does not work either because the stylus typically generates a lot more noise of its own when playing a blank disc than it does when playing unmodulated grooves. We're not too sure why this happens, but it does.

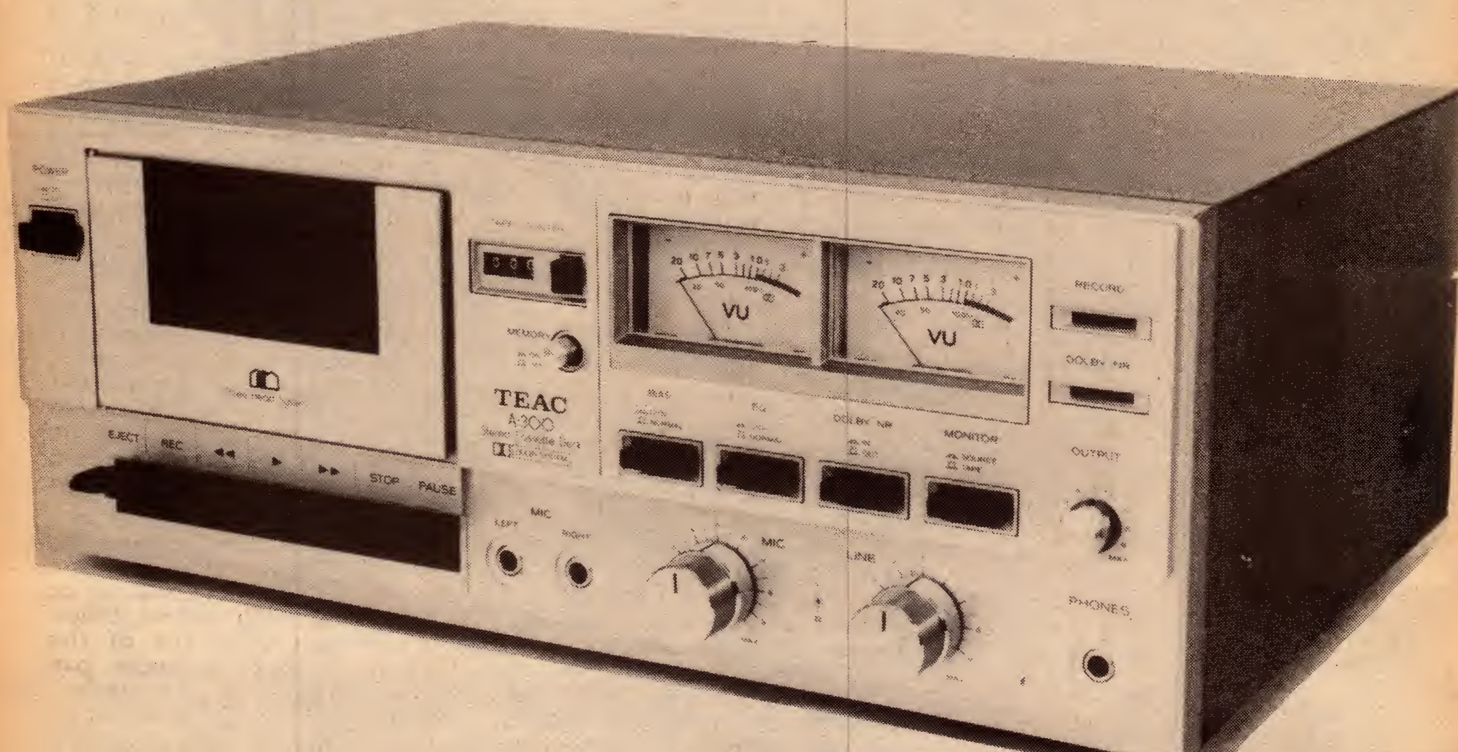
So where does that leave us as far as quantitative rumble tests are concerned? Right up the proverbial creek without a paddle (or variations on that theme).

All that we can do is to check turntable for rumble and see that it gives a result which is objectively and subjectively low. Then we can state, fairly, that rumble is (qualitatively) low. And make no mistake, rumble on most belt-drive and direct drive turntables is very low. But with the current state of test equipment available we do not feel confident in quoting a quantitative result.

Some, if not most, manufacturers quote very low figures for their turntable rumble (mostly a DIN standard measurement). How do they measure it? That is an interesting question . . .

deserves a splendid performer

Priced at around $350.



The TEAC A-300 is a surprisingly affordable 3-head cassette deck that really gets down to business when it comes to reproduction performance. The reason is an exceptionally stable transport system.
With three heads, the requirements for tape-to-head contact, flutter and tape speed stability are critical.
An inferior transport can actually result in reduced recording and playback quality—even though the unit may boast independent erase, record and playback heads.
That's why we put so much effort into making sure that the A-300 transport complements the three-head system perfectly.
We even went so far as to add a mechanical tension servo in the tape path between the supply reel and heads to assure optimum tape-to-head contact from the beginning to end of every reel.
Technically, the result is improved recording efficiency and extended frequency response with playback level fluctuation and dropouts virtually eliminated.
To you, it simply means stunning sound quality plus the convenience of real-time monitoring.
You can even monitor your tapes Dolby-decoded as you record,
since the A-300 has a double Dolby NR system—four processors instead of the usual two.
And there's a whole list of other features that make recording more convenient and enjoyable.
Try a TEAC A-300, and find out what 3-head reproduction is really all about.

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Teac A-300 3-head stereo cassette deck

Following the introduction of the highly successful A-107 cassette deck which we reviewed in August 1978. Teac have now introduced a 3-head version at what must regarded as a very attractive price. As well as having all the features of the A-107, the new A-300 also has mic/line mixing.

At first sight, the new Teac A-300 looks a "dead ringer" for the 2-head A-107 machine referred to above. The A-300 has exactly the same control layout, the same number of knobs and switches and the same overall dimensions. Only a closer look reveals that the type number, A-300, and the control labelling is different.

In fact, apart from the fact that the cassette compartment lid is labelled "Three Head System", there is absolutely nothing to indicate that the machine actually has three heads. Even a glance inside the cassette compartment only reveals two heads, leading to the exclamation "Hey, where is the third head?"

With the cassette compartment lid removed for closer examination, no third head is suddenly revealed to verify the third head claim; the machine appears to have a normal record-play head just like any other conventional stereo cassette deck. Hmm . . .

What Teac have actually managed to do is to build two separate stereo tape heads within the one case, so that the result looks just like a normal two-head set-up. This avoids having to poke a third head into a part of the cassette which was never intended for that purpose, and means that the same transport can be used as on the other conventional decks in the range. Clever, cunning Teac!

Teac have yet to tell the story of how they managed to fit two heads into the one case, and perhaps they will not do so. But it would be interesting to know whether there was any compromise to know whether there was any compromise in performance involved with the necessarily different head structure. Perhaps we will have to draw our own conclusions from the results of our performance tests.

As far as the transport is concerned, it provides the same functions as in the A-107 and related A-100 series models. Seven piano levers control the mechanism. They work well and only require moderate pressure.

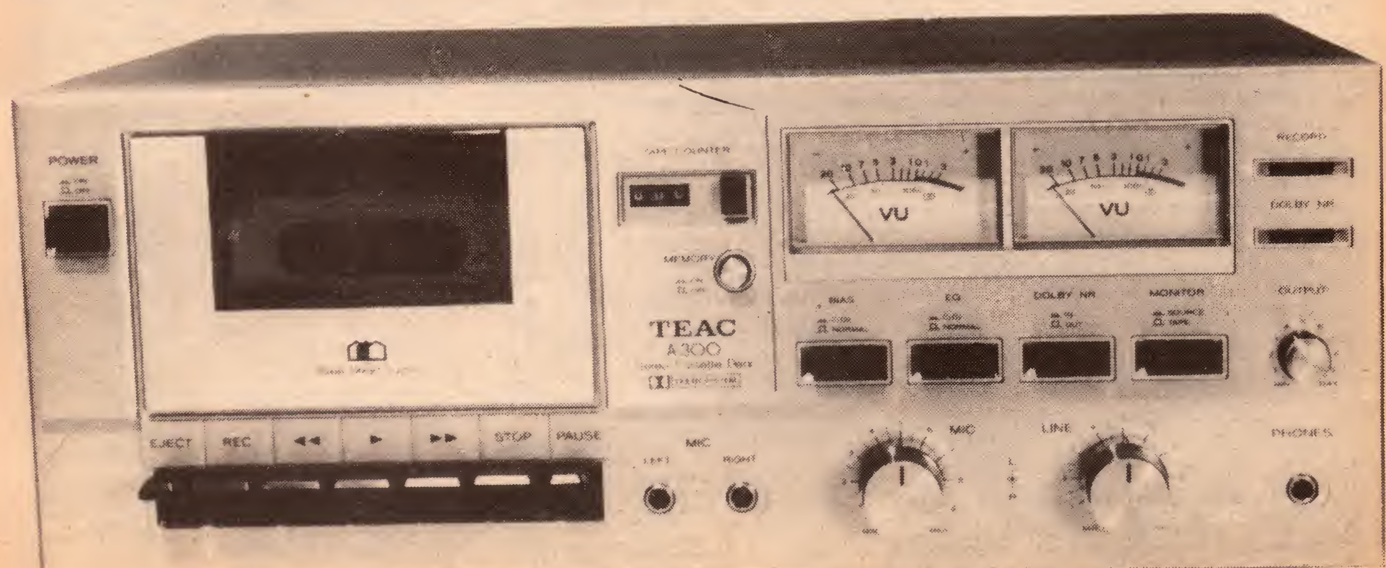
The A-300 may be set up initially for recording by first depressing the Pause button and then pressing the Record and Playback levers. There is a trick to this, as we found with the A-107: the Record lever must first be fully depressed and then held down while the Playback lever is pressed down. This locks the transport into the recording mode.

Apart from this wrinkle, the transport works very well and is particularly quiet at all times. Like most other decks it has automatic stop at the end of tape travel in all modes, and also features "memory" rewind whereby the tape can be rewound to a preset "000" on the tape counter and then stop. Rewind time for a C-60 cassette was about 76 seconds.

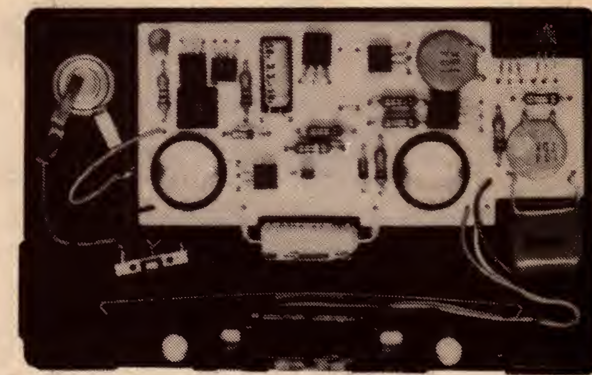
Recording facilities on the A-300 are improved compared to those on the A-107. Whereas the A-107 gave a choice between recording from microphones or line inputs, the A-300 enables mixing from both these sources for much more flexible recording. The microphone and line input controls use two concentric knobs with both halves (of each pair) clutched together for normal operation.

The two level meters have easily readable calibrations and characteristics which appear to be similar to those of VU meters. Unfortunately, the accuracy of the calibrations is none too precise, particularly at the low end of the scale.

We would have preferred to see some sort of overload indicators in ad-



TDK's Revolutionary New Product — The HD-01 Head Demagnetizer Built into a Cassette Shell.

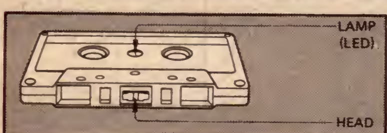


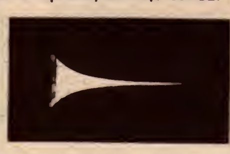
Simply load the HD-01 into any cassette recorder as you would a standard audio cassette and depress the 'play' button.

The HD-01 Head Demagnetizer was designed by TDK for easy, convenient head demagnetization of any cassette deck, insuring crystal-clear, perfect recordings every time.

The TDK HD-01 Head Demagnetizer features:

- A unique cassette format, designed to insure complete compatibility with any cassette deck.
- Powerful de-gaussing circuit instantly demagnetizes recorder heads the moment the play button is depressed. The above diagram depicts the oscillating waveform applied to the recorder heads, removing every trace of residual magnetism in only one second!
- A red LED (Light Emitting Diode) built into the HD-01 cassette shell will light up the moment your recorder heads have been completely demagnetized.





The TDK HD-01 Head Demagnetizer ends forever the fuss and mystique surrounding the demagnetization process and is much easier to use than conventional wand-type tools. Anyone can use the HD-01 and get perfect results every time.

The TDK HD-01 Head Demagnetizer is completely self-contained, battery operated and portable. It can be taken anywhere and stored with your present audio cassettes. The TDK HD-01 is ideal for all types of cassette decks especially those with heads located in hard to get at places such as:

- recorders with heads positioned in the front of the unit but which point to the rear.
- those with 'pop up' loading mechanisms which can not be detached, thus making the heads almost inaccessible.
- cassette decks with heads positioned laterally with respect to cassette loading (car decks are good example of this type).
- automatic loading machines.

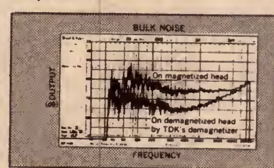
WHY IS DEMAGNETIZING SO IMPORTANT?

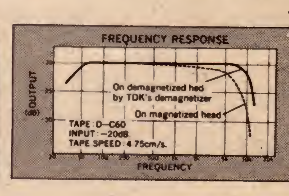
TDK, in conjunction with many cassette deck manufacturers, recommend that cassette decks be maintained on a regular basis. Cleaning the heads, capstan and pinch rollers is one important aspect of that maintenance program. — Periodic demagnetizing, about every thirty hours of use, is the other. Failure to do so will cause a build-up residual magnetism on the heads, which can seriously affect tape and machine performance in the following critical areas:

1. The noise level in the low and midrange frequencies is increased by 5 to 7dB, thereby reducing the overall signal-to-noise ratio.
2. Pre-recorded tapes can also be affected with midrange and high frequency distortion, as well as attenuation by as much as 2 to 6 dB, virtually eliminating any hopes for clear sound reproduction.

The interaction of these factors will not only prevent both the tape deck and tape from displaying their true performance capabilities, but will severely limit the Dynamic Range properties of both, rendering pure sound reproduction an impossibility.

The following comparison data clearly demonstrates the effect of residual magnetism on recorder heads in the areas of both Noise Level and Frequency Response.





TECHNICAL DATA

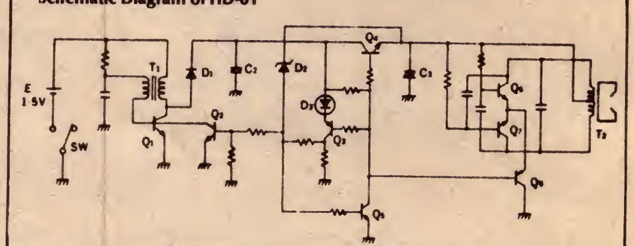
Major Components:
Transistors (8)
Diodes (2)
LED (Light Emitting Diode)

Power Supply — Control Section — Oscillation Section — Head Section

Specifications:

Maximum Magnetic Flux Density	200 Gauss
Oscillation Frequency	630 Hz
Shape	(External Dimensions) Conform to IEC Standards
Battery for Power Supply	G-13 1.5 volt, Silver Oxide Battery (option)

Schematic Diagram of HD-01



For additional information, direct all inquiries to:

TDK AUSTRALIA PTY LTD
4 Dowling Street, Woolloomooloo, N.S.W. 2011
Telephone: (02) 358-2088. Telex: AA23111

TDK®

dition to the meters, which are relatively slow in their response. There are two lamp indicators, one for the recording function and the other to show that Dolby is in use.

The four bar-shaped pushbuttons on the front panel provide the following functions: Bias, Equalisation, Dolby Noise-reduction and Monitor. The last named function allows monitoring of the Source being recorded or the signal off the tape, via the third (playback) head. The output level to the line sockets is controlled by a small knob at the right hand side of the panel. This does not affect the drive level to the headphone socket.

Sockets of 6.5mm are provided for stereo headphones and two low impedance microphones (600 ohms or more). The rear panel is bare except for the four RCA sockets and accompanying DIN socket.

Removing the cover of the A-300 reveals many similarities to, but quite a few differences from the A-107 model. The compact transport mechanism is virtually identical except for extra sets of contacts for the Pause function. The transport employs a single DC motor with tachometric feedback. It drives the capstan via a flat belt.

One of the interesting features of the A-300 transport is the eject mechanism. This controls the speed of opening of the cassette compartment lid via a gear driven flywheel system. This works quietly and well.

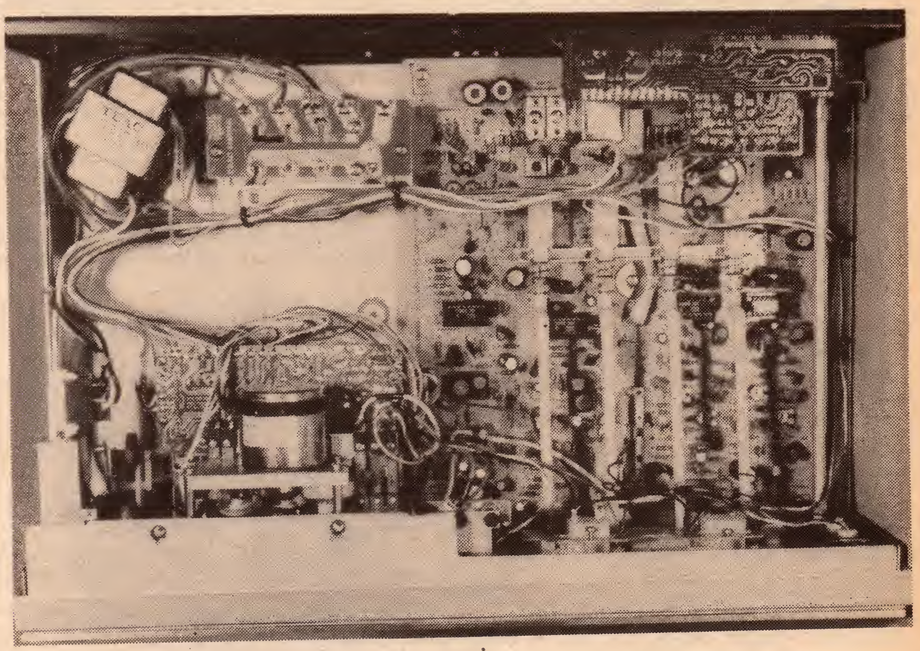
While most readers would regard the interior of the sample A-300 we reviwed as being relatively uncluttered and tidy, the model which will actually be on sale to the Australian public is even tidier. The model we reviewed is the Teac "general export" model which has a crude and rather dangerous PCB and slide system for selection of mains voltage. The Australian model does not have a multi-tap primary winding on the transformer, and thus no voltage selector.

One point which did cause some concern was a couple of loose screws in a bracket which retains the meters. We did not notice this fault until after the photographs were taken. We hope that this does not indicate a lack of vigilance in Teac quality control. Admittedly our review sample was probably a demonstration model which has been rattled around much of Australia.

One major difference is to be expected between the A-300 under review and the A-107 and that concerns the main PCB. While the main PCB on the A-300 is only slightly larger (wider) than the PCB in the A-107 and accommodates roughly twice as much circuitry, the switching is considerably less complicated.

This is because the A-300 uses completely separate circuitry for the recording and replay functions, while most conventional two-head machines use the same circuitry for both functions. This latter approach involves virtually turning the record-play amplifier inside-out by using a large multi-contact switch to switch bias, equalisation, inputs and outputs. The A-300 does away with all of that so that its recording switch is very small and mainly controls the bias and erase oscillator. So even though the A-300 has considerably more circuitry, the absence of complicated switching must be an aid to reliability. Anyway, its certainly more appealing from an engineering point of view.

One feature which we would have liked to see in this three-head machine is the facility for optimising bias to suit



particular tapes. This is relatively easy to provide on this sort of deck. Still, we have to acknowledge that the machine is very competitively priced.

The instruction manual is written in no less than five languages and since these are all laid out across each two-page spread, it is a little confusing to read. But we do approve of the fact that the circuit diagram is included in the manual.

Bias and equalisation settings for a total of 18 different tape types are given in a handy chart form at the front of the manual. This is another good feature of the manual.

Our tests of the A-300 indicate that while it is well-designed and has a high degree of running refinement, its electrical performance is not quite up to the mark of the A-107. Frequency response with BASF Cr02 tape was within ±2.5dB from 30Hz to 15kHz, but nowhere near as flat when Dolby was switched in. With TDK SA tape the frequency response was within ±3dB from 30Hz to 15kHz and although the response with Dolby changed, it remained within the same limits.

Frequency response above 15kHz is heavily attenuated by the inbuilt 19kHz filter.

Harmonic distortion was reasonably low, the figures at OVU being 1.1% at 100Hz, 1.5% at 1kHz and 1.5% at 10kHz.

Unweighted signal-to-noise ratio without Dolby applied was 48dB. With Dolby applied, this figure improved to 50dB, which does not reflect the increased improvement at the high frequency end. In fact, most of the noise from the A-300 is of a low frequency nature which means that subjectively, the unit is very quiet.

Wow and flutter checked out at around 0.15% according to the DIN 45507 measurement.

Overall sound quality on playback is good without Dolby, although some tape hiss is noticeable. With Dolby applied, the hiss largely disappears although the high frequency response suffers to a small degree.

In spite of our conclusion that the electrical performance of the Teac A-300 is not quite up to the mark set by the A-107 model we reviewed in August 1978, our overall reaction to the A-300 is enthusiastic. It is a three-head machine offering just about all the facilities which most people are likely to want, at a very keen price. Recommended retail price is $314, including sales tax.

Further information on the Teac A-300 can be obtained from high fidelity retailers or from the Australian distributors, Teac Australia Pty Ltd, 165 Gladstone Street, South Melbourne, Victoria. (L.D.S.)

Sennheiser HD420 & HD430 dynamic Headphones

The well known range of Sennheiser headphones has recently been augmented by the addition of two new models designated as HD420 and HD430. Both use the so-called "Open-Aire" approach and both are dynamics of 600 ohms nominal impedance, suitable for a wide range of applications.

At the lower end of the existing Sennheiser range of dynamic headphones is the AD400, styled like a stethoscope and retailing for $38. At the top end is the HD224X, using fully enclosed drive units and selling for $122.50. The new HD420 is listed at $75.50, while the HD430 is listed at $110. At that figure, it becomes the most expensive of the open-back types.

Taking first the HD420s, the immediate impression is one of excellent design and workmanship, resulting in phones which look substantial without being cumbersome.

The drive units are mounted inside a spoked framework moulded from matte black plastic. They are faced with a cushion of gold, velvet-like material, while a further open weave layer occupies the space between the spokes at the rear.

Because of this "Open-Aire" construction, listening may be less "private" that might otherwise be the case. However, Sennheiser claim that it provides a more natural listening environment, with the sound source being less obviously clamped to the head.

The connecting cables look conventional but actually attach to the phones by means of small but stout polarised plugs. The phones are normally supplied with 3m cables having a 6.3mm stereo jack-plug termination, but they are also available with unterminated cord or with DIN multiplug connector. The literature mentions a variety of other accessories, such as a 3 or 6-channel junction box, chain connectors for 10 or 30 pairs of phones and cables with inbuilt volume/balance controls.

Manufacturer's data quotes the weight of the phones without cables as 129g, the frequency response as 18-20,000Hz (no dB reference), distortion as less than 1.0% (DIN 45500) and sound pressure level at 94dB (1mW input at 1kHz).

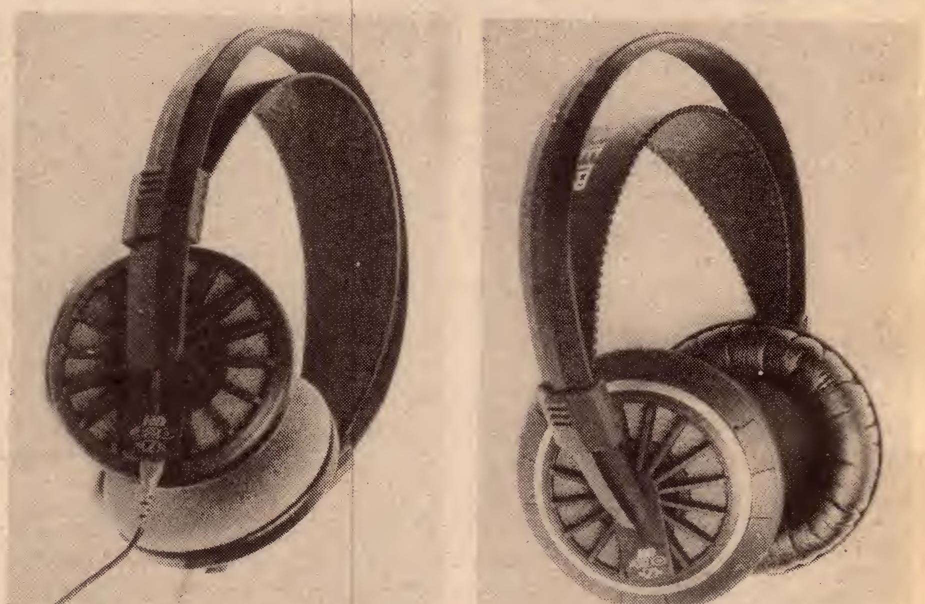
The headband has an outer arc of spring steel which presses the phones inwards against the ears and, being hinged, they automatically assume the correct angle. Inside the spring steel arc is a soft strap which can be slid up or down as necessary to support the phones at the appropriate level. Once adjusted, the phones sit firmly but comfortably in place.

Observed on a range of program material, the sound is clean and well balanced. While the drivers are not sealed against the head, the bass is nevertheless firm and subjectively equivalent to what one would expect to hear from the same material quality loudspeakers.

There is a slight tendency to emphasise speech sibilants in the range around 4kHz, but it is much less apparent than with many other phones. To many listeners, the effect will merely tend to increase the "presence" of both speech and music; overall, they should be very easy-to-live-with phones.

The more expensive model, HD430, is of generally similar construction but with the obvious difference that the phones carry pads which surround the ears, rather than cushions which rest directly on them. Sennheiser stress, however, that the phones still qualify as "Open-Aire" types, because the back is open and accessible to normal room ambience.

Specifications of the HD430 are marginally higher than those of the HD420 but we doubt that too many would notice any significant difference in the subjective sound quality. The bass was judged to have a slightly more "shut in" sound and the upper middles to be slightly more restrained. But, again, these are niggling observations about a product that would be very easy to live with.



On the left, the HD420 and, on the right, the HD430 phones.

At 190g, the HD430 phones are heavier and the pads make them look larger. But we know from experience that some prefer phones to be built this way, finding pressure on the skull less objectionable than on the pinna. It's very much a subjective reaction, which we leave with the individual.

For further details: R. H. Cunningham Pty Ltd, PO Box 453 Melbourne 3001. Or PO Box 214, Neutral Bay Junction, NSW 2089. (W.N.W.)

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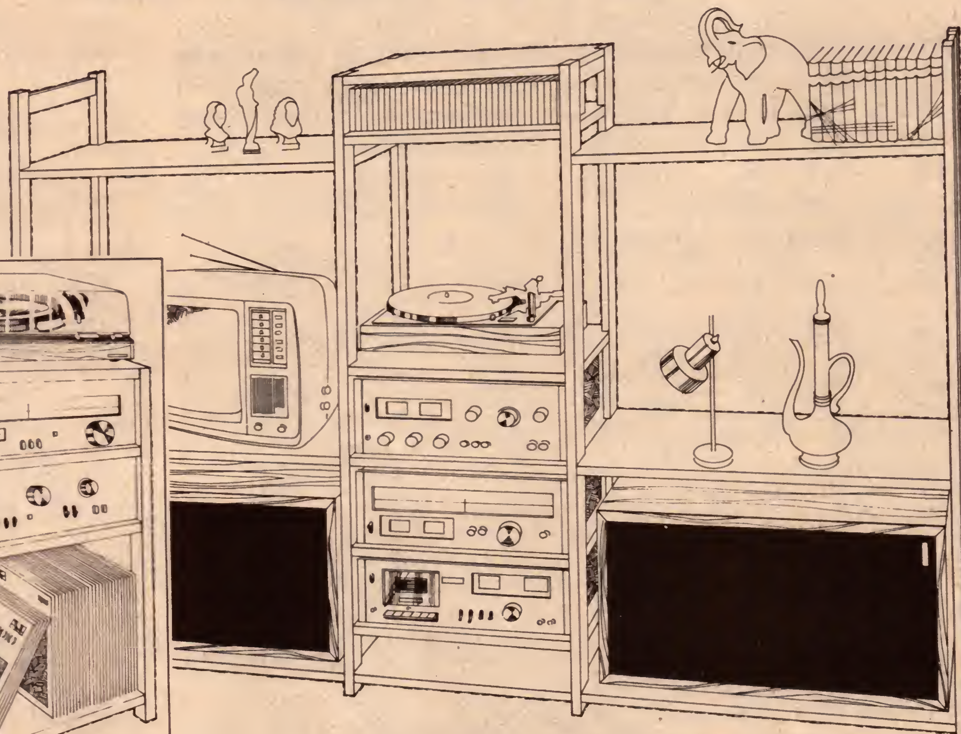

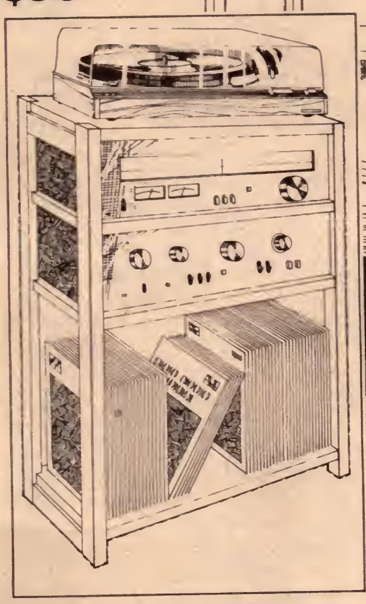

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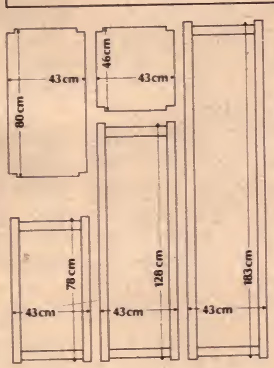

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ACT	BELCONNEN	Whitewood Warehouse, Cohen St., Ph: 51 4474
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An electronic combination lock

Give your home, flat or office increased security with this space-age electronic combination lock. Low in price and easy to build, it can be programmed to respond to any desired seven-digit code. This means that an intruder or other unauthorised person has only one chance in 10,000,000 of finding the correct code!

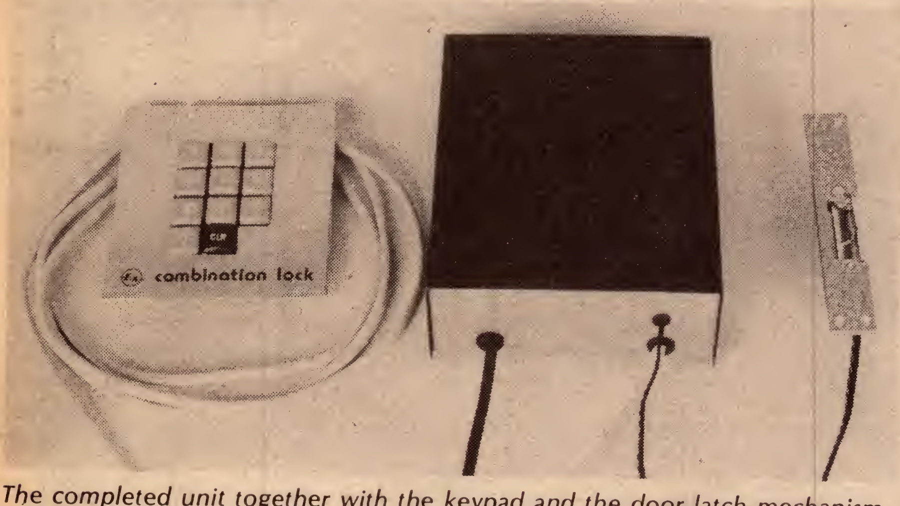
by RON DE JONG

Here is a new electronic combination lock design which we think should become very popular. It offers the security of more complex designs with the simplicity and low cost of simpler and less secure circuits. You can fit it fairly easily to almost any home, flat or office front door, and it can even be fitted with multiple input keyboards if you wish.

The actual code combination to which the lock responds is set by seven wire programming links inside the lock case — which is separate from the entry keyboard, for both convenience and security. While not normally accessible, the links can be changed at any time if desired, if you suspect that the code has become known to any unauthorised person. The code may be set to any desired combination of seven decimal digits — giving a total of 10,000,000 possibilities to choose from!

In use, the lock is triggered by entering in the code digits via a small keyboard whose keys are labelled 0-9. This provides elegant and fast entry, at the same time leaving no indication of what the code may be. The lock circuit is arranged so that the only way to release the door latch is to enter the correct code digits in the correct order, and with no false digits between them. Any false digits will immediately cause the circuit to reset, even if some correct digits were keyed in.

Like most electronic combination locks, the unit is designed to activate an electric latch release mechanism of the type commonly used in flats and home units. This type of latch release can be used in conjunction with an ordinary key-activated door latch, in place of the usual fixed striker plate. If this is done, you can gain entry by using either the combination lock or the normal key.



The completed unit together with the keypad and the door latch mechanism.

You can of course use the combination lock and release mechanism quite separately from the normal key-operated latch, to provide additional security. In this case it would probably be used with an "exit latch" door bolt, which can otherwise only be opened from the inside by a turn unit. Or you can use the latter arrangement by itself, so that the combination lock provides the sole means of gaining entry from the outside. The only problem with both of these arrangements is that in the event of a power failure, it can be very difficult to gain entry!

Assuming mains failure is not regarded as a problem, you could also use this combination lock with two keyboards — one on the inside and one on the outside of the door. This will give a "deadlock" effect, so that even if illegal entry is made via a window or other means, stolen items cannot be moved out by opening the door from the inside.

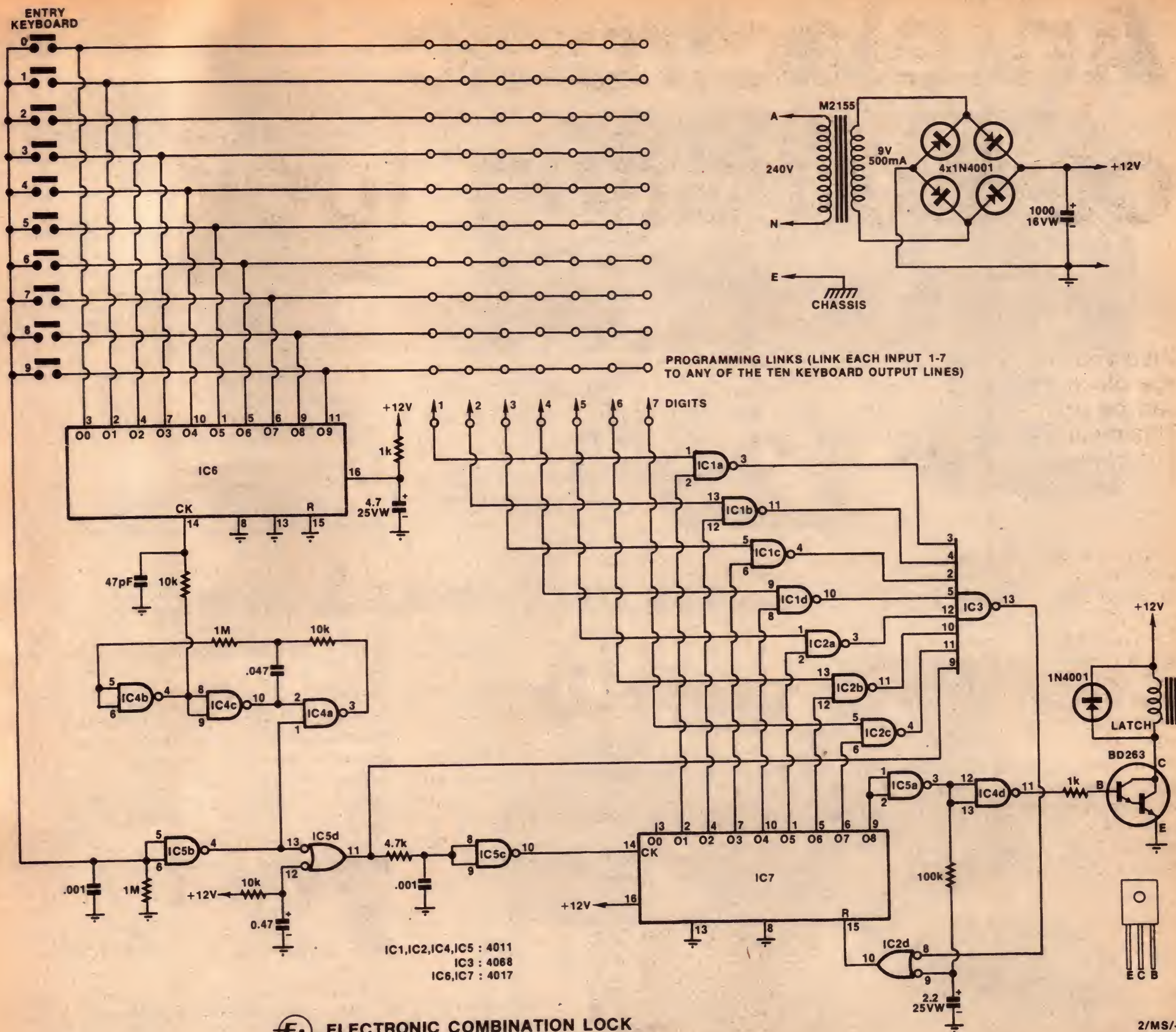
The electronic part of the lock uses only seven inexpensive CMOS integrated circuits and a transistor, all powered from a simple 12V supply. But the simplicity of the circuit belies its performance.

The easiest way of following circuit operation is to divide it into two distinct functional parts: the keyboard scanner and the code verification circuits.

At the centre of the keyboard scanner section is IC6, a 4017 decade counter with internally decoded outputs. This is driven by a clock oscillator formed by gates IC4b, IC4c and IC4a, and the oscillator is normally free-running at about 1kHz.

Each of the ten output lines of the counter is connected via the keyboard switches to the input of gate IC5b. This in turn is used to control the clock oscillator. As a result if any of the keys is pressed, the clock oscillator is disabled by IC5b as soon as the corresponding output of the counter goes high — which will happen within ten milliseconds. The counter will thus stop with the output line which corresponds to the pressed key held in the high state.

As well as being used to stop the keyboard scanning clock, the output from IC5b is also processed by IC5d and



Seven low-cost ICs make up the circuit; programming links are added to make up the desired 7-digit code.

IC5c to produce two "key pressed" strobe signals for the code verification circuitry. The 4.7k/.001uF combination between IC5d and IC5c ensures that the signal from IC5c is slightly delayed with respect to that from IC5d, as this is required by the verification circuit.

The main reason for using this keyboard scanning circuit is to ensure that only one output line goes high, no matter how many keys may be pressed simultaneously. This is because the 4017 can only have one of its outputs high at any particular time. As a result, it becomes impossible to "fool" the code verification circuit by pressing all keys down at once.

A further advantage of the scanning approach is that the .001uF capacitor and 1M resistor at the input of IC5b effectively debounce all of the keyswitches at once.

When the key which was pressed is finally released, IC6 does not immediately revert to scanning the keyboard again: there is a short delay. Partly this delay is due to the .001uF/1M combination at the input of IC5b, which produces a delay of around 1ms before the input of IC5b falls to logic low, its output rises to logic high and the clock oscillator is allowed to restart.

The remainder of the delay is produced because the input of IC6 is driven from the output of IC4b in the clock oscillator, rather than from the more usual point at the output of IC4a. As a result when the clock oscillator restarts there is a half-cycle delay before the input of IC6 receives its first positive-going clock transition. Since IC6 is triggered only by positive-going clock edges, this ensures that the output of IC6 remains "frozen" for approximately 1.5ms after the release of the keyswitch.

Note that in addition to producing the "key pressed" strobe signals, IC5d and IC5c are also used to generate a similar pair of pulses when power is first applied to the lock circuit. These pulses are generated by the 10k/4.7uF combination connected to the second input of IC5d, and are used to initialise the code verification circuitry.

The code verification section of the circuit takes the consecutive outputs from the keyboard scanning section, as a series of keys are pressed, and checks if the correct keys have been pressed in the programmed sequence. Only if the sequence is correct in all respects does it finally activate the latch release mechanism.

This section of the circuit is again based on a 4017 decoded decade counter device, IC7. In broad terms the circuit works by starting with the counter in the zero state, and incrementing it by one count for every correct digit entered in its correct position in the

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Quality Base Station on a Budget

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Specifications

Sensitivity for 10 dB S + N/N: 0.5 microvolt. **Adjacent Channel Rejection:** 80 dB. **Audio Output:** 5 watts max. **RF Output:** 4 watts max. **Spurious Radiation:** Better than −65 dB. **Frequency Tolerance:** Better than 0.002%. **Modulation Capability:** 90 to 100%. **Power Requirement:** 240VAC. **Size:** 12.0x30.0x24.7cm.

REALISTIC Low-Cost AM CB with Advanced Features

Realistic TRC-420. Compact, yet loaded with features for "big radio" performance. Auto-modulation to maximise your talk-power. Two ceramic filters for superior selectivity and freedom from adjacent channel interference. Features lighted S/RF meter, full-time ANL, external speaker jack. With mobile mounting bracket, dynamic mike with locking plug. DC power cables. 21-9420

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Regular Retail Price **89.95**

Specifications

Sensitivity for 10 dB S + N/N: 0.5 microvolts. **Adjacent Channel Rejection:** 60 dB at 10 kHz. **Audio Power Output:** 5 watts maximum. **RF Power Output:** 4 watts maximum. **Power Requirement:** 12VDC positive or negative ground. **Size:** 4.1x13.3x19.6cm.

AM/SSB Base — Goes Mobile Too!

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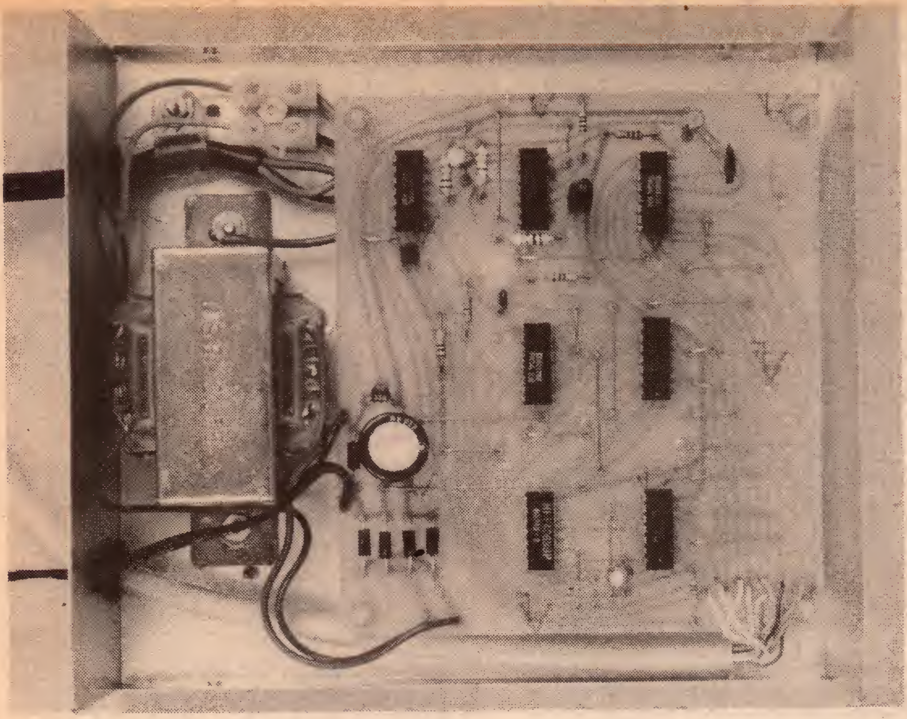


Inside the completed electronic combination lock. Programming links have been added here to give a 0123456 demonstration code.

PARTS LIST

- 1 Instrument case, 184 x 70 x 160mm
- 1 Power transformer, 9V at 1A; A&R type 2155, PF2155, M-2155 or similar.
- 1 PC board, 114 x 130mm, coded 79CL7
- 1 Pack of 11 keyswitches (see text)
- 1 PC board, 89 x 91mm, coded 79KB7
- 1 Mains cord and plug
- 1 Length of 6-pair telephone cable
- 1 Length of 2-wire cable, light figure-8 type
- Grommets, cable clamps, termination block, etc.

SEMICONDUCTORS
- 4 4011 CMOS integrated circuits
- 2 4017 CMOS integrated circuits
- 1 4068 CMOS integrated circuit
- 1 BD263 Darlington transistor
- 5 1N4001 power diodes or similar

CAPACITORS
- 1 47pF ceramic or polystyrene
- 2 .001uF polyester
- 1 .047uF polyester
- 1 0.47uF 25VW tantalum
- 1 2.2uF 25VW electrolytic PC-type
- 1 4.7uF 25VW electrolytic PC-type type
- 1 1000uF 16VW PC-type electrolytic

RESISTORS
All half-watt 5%: 2 x 1k, 1 x 4.7k, 3 x 10k, 1 x 100k, 2 x 1M

Note: Resistor wattage ratings and capacitor voltage ratings are those used in the prototype. Components with higher ratings may generally be used, providing they are physically compatible. Components with lower ratings may also be used in some cases, provided that the ratings are not exceeded.

sequence. Any incorrect digit or correct digit in the wrong position immediately causes the counter to be reset to zero again. Only if all seven digits have been keyed in correctly does the counter reach the count of 7, and cause the latch release to be activated.

In greater detail, note that each of the outputs 01-07 of the counter is taken to one input of a series of 2-input NAND gates, IC1a — IC2c. The other input of each gate is connected to one of the seven programming links, and thence to one of the 10 output lines from the keyboard scanning section. The outputs of the 2-input gates are taken in turn to seven of the inputs of IC3, an 8-input NAND gate. The output of IC3 is taken via IC2d, connected as a negative-input OR gate, to the reset input of the counter.

The second input of IC2d is connected to the output of IC5a via a 100k/2.2uF delay circuit, which performs two functions. One function is to hold the second input of IC2d low when power is first applied to the circuit, forcing the output of IC2d high and ensuring that IC7 powers up in the reset-to-zero state. The second function will be made evident shortly.

Of the two "key pressed" strobe signals generated by the keyboard scanning circuit, the undelayed signal from IC5d is taken to the eighth input of IC3. The delayed signal from IC5c is taken to the clock input of IC7, the verification counter.

Although IC7 is reset to zero when power is first applied to the circuit, this is not the verification circuit's normal

We estimate that the current cost of parts for this project is approximately

$35.00

This includes sales tax, but does not include the cost of the electric latch release mechanism required.

"quiescent" condition — which is with IC7 set to the count of 1. It moves into this state as soon as any key is pressed (it doesn't matter which key).

This happens in the following manner. With IC7 reset to zero, none of the gates IC1a — IC2c are enabled because outputs 01-08 of the counter are all at logic low. Regardless of the key pressed, then, all of the outputs of these gates will remain at logic high. As a result the undelayed "key pressed" pulse from IC5d will be able to progress through IC3 and then IC2d, and force IC7 back to the reset-to-zero state (in case it was not already in that state). However shortly afterward the delayed pulse from IC5c will be fed to the clock input of IC7, incrementing it to the count-of-1 state.

It is in the latter state that IC7 becomes capable of responding to the correct sequence of input digits as programmed by the wire links.

When the circuit is awaiting the first digit in the sequence, IC7 has a high logic level at output 01 (pin 2). This enables gate IC1a. If the correct key is then pressed, corresponding to the keyboard line connected to IC1a's input via link 1, this gate will therefore produce a logic low at its output.

As a result of this, gate IC3 will be disabled and the "keypressed" signal from IC5d will not be able to pass through to reset IC7. When the delayed signal from IC5d arrives at the clock input of IC7 it will therefore be able to increment the counter to its next count, with output 02 high ready for the next digit.

The thing to note is that the undelayed "key pressed" pulse from IC5d is only prevented from resetting IC7 if the correct digit key has been pressed, to enable the currentlyactive two-input gate and disable IC3. Pressing any other key will not cause IC3 to be disabled, and the counter will be reset to zero and then incremented back to 1 again.

Combination lock

Exactly the same thing happens for each of the succeeding digits. Once the counter has reached the count of 2, for example, the only key that can make it progress to the count of 3 is the key which causes gate IC1b to produce a low output and disable IC3. Any other key allows IC3 to pass the reset pulse, so that IC7 is forced back to the count of 1 again. And so on.

So that only the correct sequence of digits keyed in without a false digit between them will cause IC7 to count up to the count of 8. Any false digit any where in the sequence will force IC7 right back to "first base".

Note that in the foregoing explanation, we have talked about the "key pressed" pulses from IC5d and IC5c as if they were narrow pulses. In fact they are quite long, lasting as long as a key is held depressed. However the essential thing is that the clock signal from IC5c triggers IC7 on its positive-going transitions, which occur about 5 microseconds after the reset signal from IC5d falls to the inactive level — just after the key is released.

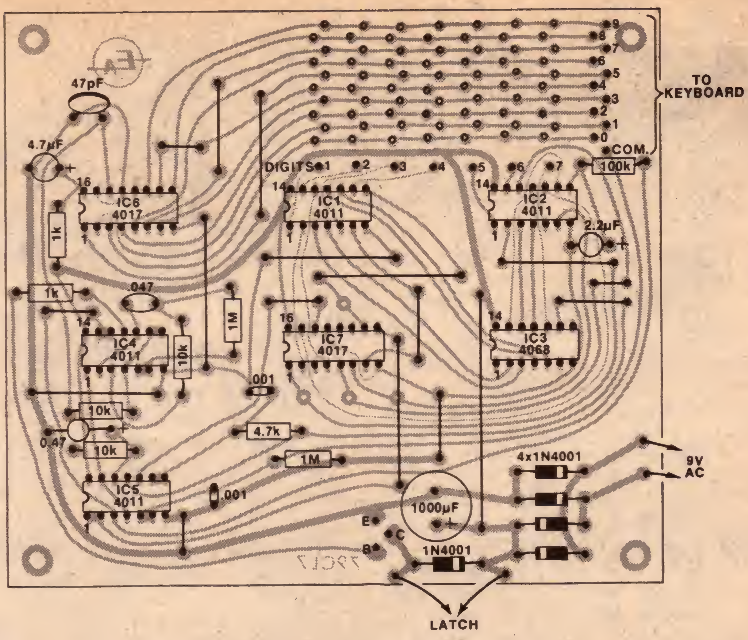
What this means is that when a key is pressed, IC7 will either be immediately reset to zero if the wrong key is pressed, or will remain at its current count if the correct key is pressed. Then when the key is released, the counter will increment — to either the count of 1 or the next apppropriate count,as the case may be.

Assuming the correct sequence of digits has been keyed in, counter IC7 finally reaches the count of 8 and its output 08 goes high. As gate IC5a is connected to this output as an inverter, its output accordingly goes low. This does two things, the first of which is to activate the latch release mechanism via gate IC4d (also wired as an inverter) and the BD263 Darlington transistor.

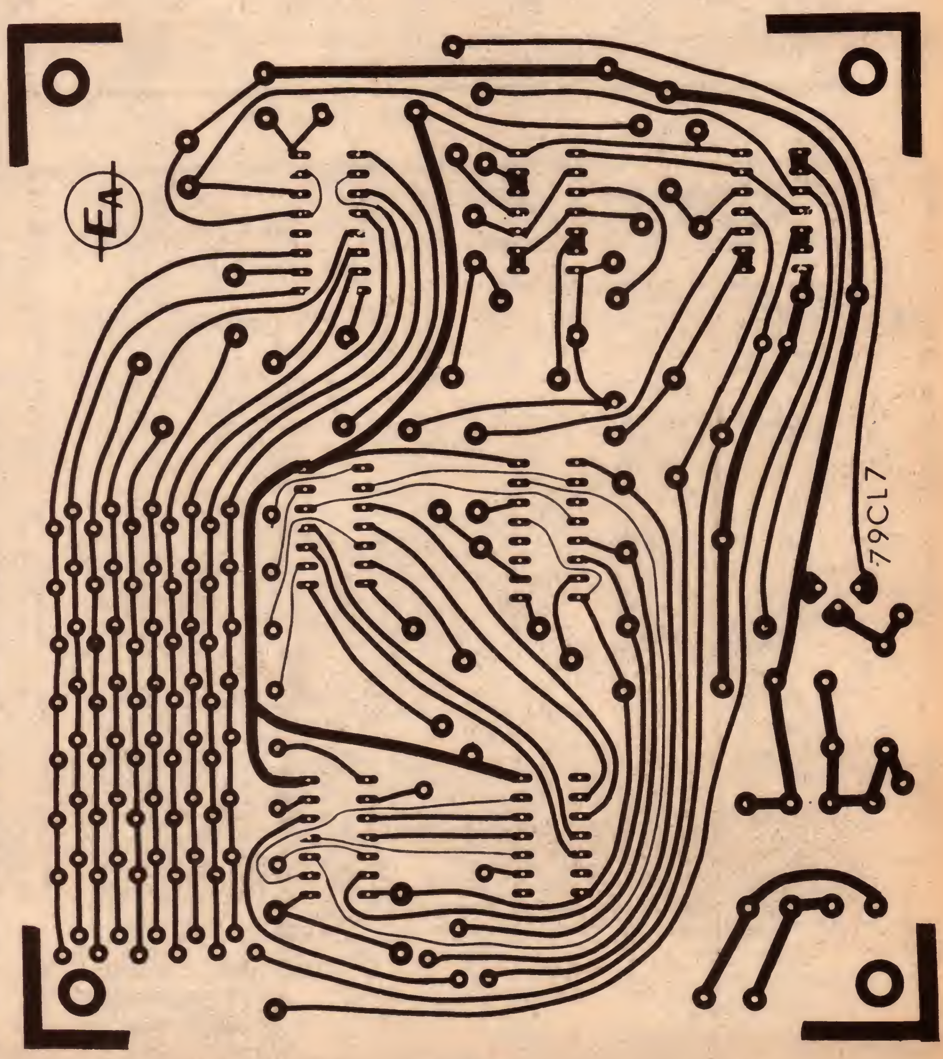
The second thing that happens is that the low at the output of IC5a is fed to the second input of IC2d, via the 100k/2.2uF delay circuit. As a result the second input of IC2d goes low after approximately 150 milliseconds, resetting IC7 to its zero state once again and deactivating the latch release mechanism.

Note that since IC7 is again reset to the zero state, it must be forced into its count-of-one state before it can accept the correct code sequence again. As when power is first applied, then, you have to key in a "dummy" digit before you key in the correct code. This is really no trouble, and if anything will make it harder for an intruder to find the correct combination.

The latch release or "electric strike" mechanism we have used with the lock is designed for pulsed operation, and thus operated quite happily from the



Use this overlay diagram in conjunction with the circuit to assemble your unit. Don't forget to add programming links to make up the 7-digit code you require.



Here is an actual size reproduction of the main PC pattern.

150ms pulse delivered by the circuit. The pulse of current triggers an internal release mechanism, which allows the door to be opened at any time afterwards — there's no need to hurry. The release resets as soon as it springs back into place when the door is opened.

Made in Spain by Golmar S.A., the mechanism is designated type CV-24 and is rated to draw about 1A from a nominal 12V DC supply. It is imported by Habitech Pty Ltd, of 14 Northcote Street, St. Leonards, NSW 2065, who sell directly to the public, but you can also buy it from their interstate distributors or from sepecialist locksmiths. The recommended retail price is $37.00.

In Sydney you can buy them from North Shore Locksmiths of 75 Willoughby Road, Crows Nest 2065, or from Independent Locksmiths of 92 George Street, Parramatta 2150. In Melbourne they are available from Style Finnish (Security) Pty Ltd, Factory 5, 42 New Street, Ringwood 3134 (PO Box 80), and in Perth from Style Finnish (WA) Pty Ltd, 398 Rokeby Road, Subiaco 6008. In Brisbane the distributors are Vacumatic Distributors Pty Ltd, 36 Gladys Street, Stones Corner 4120.

As normally supplied the CV-24 mechanism is intended to replace a mortise-type strike plate, mating with a mortise-type spring return latch. A surface-mounting adapter plate is available if required, for an additional $3.00. Habitech also have available a version of th CV-24 which will operate with combination bevel-bolt latches and double-throw deadlocks, such as the Cisa type 52111 unit which they are also able to supply.

One thing you should bear in mind is that latch release mechanisms like the CV-24 will not work with some types of deadlock and deadlatch and may need modification to work properly with other types. We suggest that you seek advice from the suppliers listed or from your local locksmith, before committing yourself.

A somewhat more rugged, heavy-duty electric strike mechanism is also made locally by DK Security. Known as the DKS unit, it is available from North Shore locksmiths in Sydney. However this unit is designed for "continuous" rather than pulsed operation — that is, it will only release the latch while power is applied. It is also rather more expensive than the price of the Golmar unit.

To use the DKS unit with our lock design, you will need to modify the circuit so that it energises the release for considerably longer than the 150ms provided for a pulsed release. You can do this by increasing the values of the

Actual size reproduction of the keyboard artwork.

RC delay components between IC5a and IC2d. If you increae the resistor from 100k to 1M and replace the capacitor with a 22uF/25VW solid tantalum, the release will be energised for about 12 seconds — which should be adequate.

This modification should also allow the lock circuit to be used with other "continuous" type release mechanisms. For example there is a Golmar release of this type, the CV-14, which is otherwise similar to the CV-24 unit. You could use the CV-14 unit with our lock, if you wish, by making the same modification.

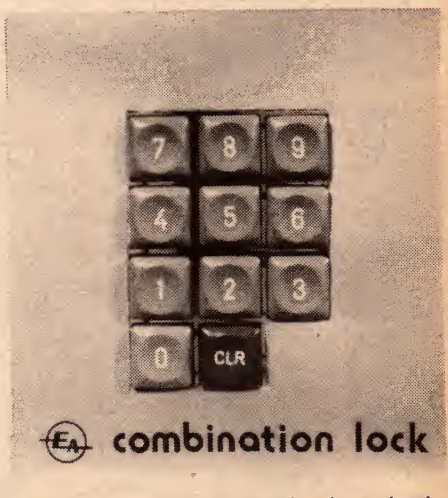
As mentioned before, the code combination to which the lock responds can be programmed as you wish, to any combination of seven digits. Each digit is set simply by connecting the appropriate 2-input gate to the corresponding output line from the keyboard scanning circuit.

Don't make the code too simple — like 1234567 — or it is likely to be guessed too easily. Similarly it might not be a good idea to make it too complex, or it might be too hard to remember! A familar telephone number might be worth using, although it might not be wise to use your own — a burglar might well have the foresight to look up your name and number! Another idea might be to use your birthdate, or some other significant figure.

If you don't really want the full protection of a seven-digit code, you can shorten the required code sequence simply by connecting the input of IC5a to one of the earlier outputs of IC7, rather than to 08. Hence by connecting it to 06 you will need only a 5-digit code, and so on.

We have designed a PC board to accommodate virtually all of the combination lock circuitry, and make construction easy. The only components which don't fit on the PCB are the power transformer, which is too bulky, and the keyboard and latch release mechanism which are in any case best separated from the main unit.

The PCB measures 114 x 130mm, and is coded 79CL7. The pattern is reproduced actual size in this article, for those who may wish to trace it or copy it photographically. Alternatively, transparencies will be available from the Information Service, and you should also be able to buy finished boards shortly from the usual suppliers.



A close-up view of the keyboard. The "CLR" key is a dummy.

Wiring up the unit should be fairly straightforward using the PCB overlay diagram and the photographs as a guide. We suggest that you leave the ICs until last when wiring up the unit, however, as they are CMOS devices

Combination lock

and can be damaged by excess static charge.

As you can see the PCB provides a matrix of holes near one corner for convenient setting of the combination code. The seven gate inputs for the verification circuit are along the side of the matrix, and all you have to do is fit a wire link from each one to any of the 10 digit lines available in a staggered row along from it. The entry keyboard or keyboards also connect to a row of holes at the end of the matrix area.

We suggest you connect the entry keyboard to the main lock unit via a length of 12-conductor ("6-pair") telephone cable, which is available from many parts stockists. This cable is round, and can be easily run through holes in walls, skirting boards and architraves. An alternative would be flat "rainbow" cable. The circuit will work reliably with up to about 5 metres of cable between the keyboard and the main lock unit, which should be adequate for most applications.

The entry keyboard should be mounted conveniently adjacent to the outside of the door to which the release mechanism is fitted. If the door is on an external entrance, the keyboard should be suitably protected from the weather as most switches are not fully waterproof.

For the keyboard itself we used a set of keyswitches which were kindly supplied by Pre-Pak Electronics, of 718 Parramatta Road, Croydon, NSW. There are eleven switches in the set, and they come with integral numbered keytops. The eleventh key is labelled "CLR". The set is available from Pre-Pak for $5.50, plus postage if applicable.

We have designed a small PCB to mount these switches. It measures 89 x 91mm, and is coded 79KB7. As you can see from the photographs it provides for the CLR switch as well as the ten numbered switches, even though the CLR switch is not connected into circuit. The idea behind this is that the CLR key becomes a dummy, to provide further potential confusion to an unauthorised person trying to gain entry.

As an alternative to the keyswitches we have used, you could use ten standard miniature pushbuttons and perhaps mount them in a small diecast metal box. The choice of keyboard and how you mount it near the door is up to you.

Don't forget that as well as the cable between the lock unit and the keyboard you also need to run a 2-wire cable to the latch release mechanism. However this can be light-duty figure-8 cable of the type used for hifi speaker connections, so it should pose few problems.

The lock circuit PCB and power transformer are housed in a small inexpensive instrument case. The case we used came from Dick Smith Electronics, and measures 184 x 70 x 160mm. It is listed under the number H-2744 in the DSE catalog.

We mounted the PCB on "Richco" moulded nylon supports, which are available from most parts stockists. The transformer was at the rear of the PCB, with the power, keyboard and latch release cables entering via grommeted holes. Needless to say the mains cable should be properly clamped after entry, with the active and neutral taken to a connector strip and the earth lead soldered to a lug bolted to the case.

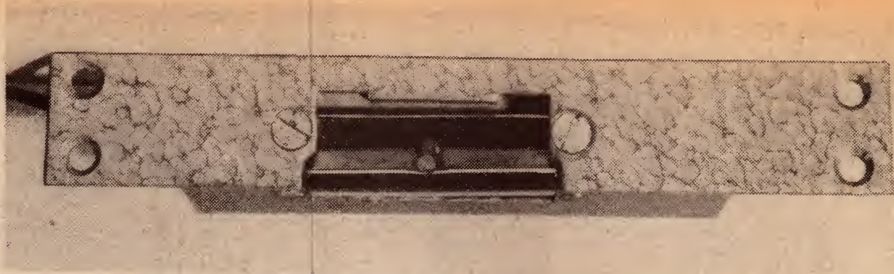
When the keyboard cable and programming links are wired to the PCB along with the power supply parts and other passive components, the ICs can be added to complete the job. Remember to take the usual precautions when dealing with CMOS devices: use a small soldering iron, preferably of the low voltage separate-element type, and use a cliplead to connect the tip and barrel of the iron to the "earthy" copper track on the PCB.

When soldering in each IC it is a good idea to solder the two supply pins first, so that the internal protection diodes can function as soon as possible. With the 16-pin devices these are pins 8 and 16; for the 14-pin devices they are pins 7 and 14.

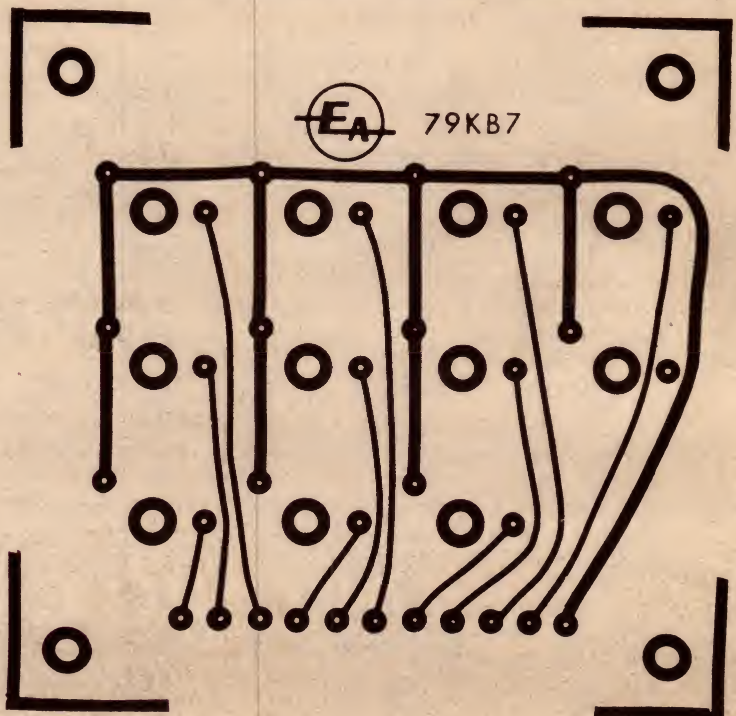
When you have finished wiring up the electronic lock we suggest that you check over all PCB connections, etc before turning on the power for the first time. Similarly it is a good idea to make sure all of the polarity or orientation-conscious components are mounted the correct way around on the PCB.

If all is well, it should be possible to turn on, key in a dummy digit and then the code combination you have programmed into the links, and hear the release mechanism operate.

A final point. Although we have described the electronic combination lock with a simple mains-type power supply, it would obviously be possible to power it from a 12V battery supply if required. This means that you could use it for a car, boat or other application away from the mains. It also means that you could use a battery back-up system, to allow the lock to operate in case of power failure. We leave these optional eleborations up to you.



Close-up view of the Golmar CV-24 door-latch mechanism.



Actual size reproduction of the keyboard PC pattern.

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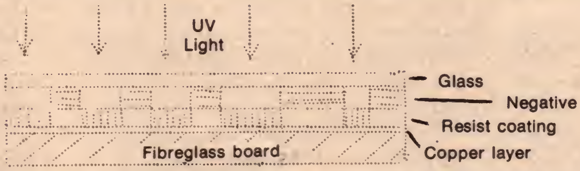

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Designing voltage reference circuits

It is often necessary in electronic circuit design to provide a stable voltage source for reference purposes. In this short article the author describes low cost ways of providing such a voltage reference.

by STEPHEN DOLDING
26 Rickard St, Merrylands NSW 2160

The need frequently arises in electronic circuits for the provision of a stable voltage source for reference by comparators, level detectors, current and voltage regulators and so on. In many cases the prime requirement in the case of the reference voltage is not so much its absolute precision, but rather its stability with respect to supply voltage and ambient temperature variations. It is normal practice to connect only a small and fixed load to such a reference supply, so that unlike voltage regulator circuits load regulation is not a problem.

The simplest approach to providing such a referenceis to use a zener diode. This is connected in shunt mode, in virtually the same manner as used for a simple regulator (Fig. 1). The zener is operated in its "reverse breakdown" mode, where its terminal voltage remains substantially constant over a wide range of current. This is illustrated by the graph in Fig. 2, where you can see that in the breakdown region the diode's voltage drop remains substantially constant at Vz for a significant range in current Iz.

The equation used to calculate the circuit values for Fig. 1 is:

$$R = (Vs - Vz)/(Iz + Il)$$

As an example let us say Vs is 12V and the zener voltage is to be 6.2V, with a load current Il of 0.8mA. Most low power zener diodes have their nominal terminal volage specified at a current of 5mA, so we can set Iz at this value. Hence

$$R = (12-6.2)/5.8 \times 10^{-3}$$
$$= 1k$$

If the zener diode current is reduced much below 5mA, the diode voltage will drop as the device operating point approaches the "knee" of its characteristic. On the other hand if the zener current is increased the diode voltage increases (as does its power dissipation). The voltage increase is due to the finite slope of its characteristic in the breakdown region (see Fig. 2).

Obviously the steeper the slope of the characteristic, or the lower its "slope resistance", the more stable will be the zener voltage with variations in unregulated supply voltage.

Low power zener diodes are readily available in a range of voltages in preferred value steps from 2.7 volts to 75 volts or more, usually with tolerances of ±5%. However, on closer observation it is seen from data on these devices that the zener diode with the lowest slope resistance in any particular production series occurs at about 6.2 volts. Hence for best results a 6.2 volt zener should be used where possible. If a lower reference voltage is required a potential divider may be used, preferably using metal film or metal glaze resistors for stabilily. Such a circuit is shown in Fig. 3. As you can see an op-amp is used as a buffer, to prevent load current from disturbing the divider ratio.

If a reference voltage higher than 6.2V is required, the circuit shown in Fig. 4 may be used. The DC gain of the amplifier is set by the ratio of two resistors:

Gain = (1 + R1/R2).

Because the most readily available zener diodes have a tolerance around

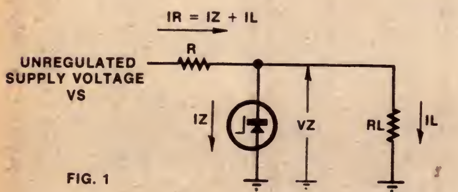


FIG. 1

Simple zener diode voltage reference.

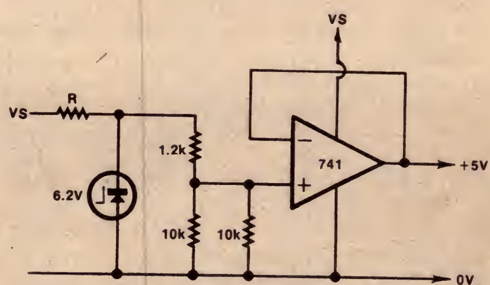


FIG. 3

A 6.3V zener, a voltage divider, and a 741 op amp make up this +5V reference.

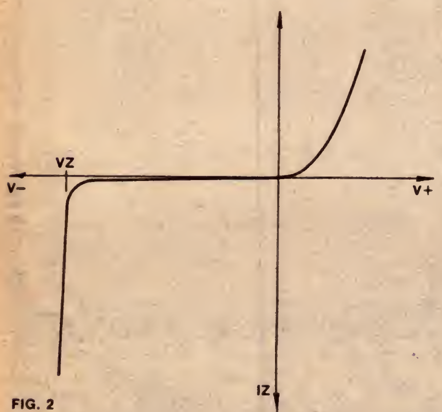
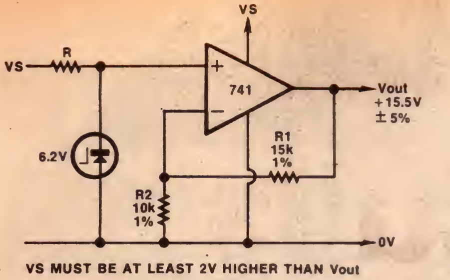


FIG. 2

Graph showing how zener diode voltage drop remains substantially constant at Vz for a large range in current Iz.



VS MUST BE AT LEAST 2V HIGHER THAN Vout

FIG. 4

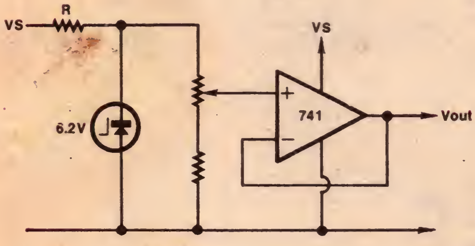


FIG. 5

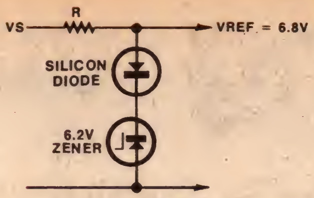


FIG. 6

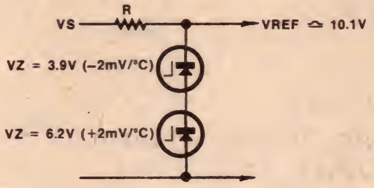


FIG. 7

Fig. 4: obtaining a reference voltage higher than the zener voltage. Fig. 5: using a preset pot to trim output voltage. Figs. 6 & 7: temperature compensated zener reference circuits.

±5% it is a good idea to include a preset potentiometer to trim the output voltage to the required level. If the wiper of the potentiometer is connected to an operational amplifier, as shown in Fig. 5, then any variations in load resistance will have no affect on the reference voltage (within the output capability of the op-amp).

On further investigation of the data sheets for zener diodes, it is also found that the ambient temperature has a marked effect on the zener voltage of any particular diode. The figure quoted is usually the temperature coefficient in mV/°C temperature change.

The lowest temperature coefficients are for zener diodes in the range 5.1 to 5.6 volts, the typical figures being -1mV/°C for 5.1 V, +0.5 mV/°C for 5.6V and + 2 mV/°C for 6.2V.

If the unregulated supply voltage variations and load variations are not severe then a single 5.1V or 5.6V zener may be used, giving a reference voltage only changing by 1% for a temperature change of 50°C. Generally this is adequate for most purposes.

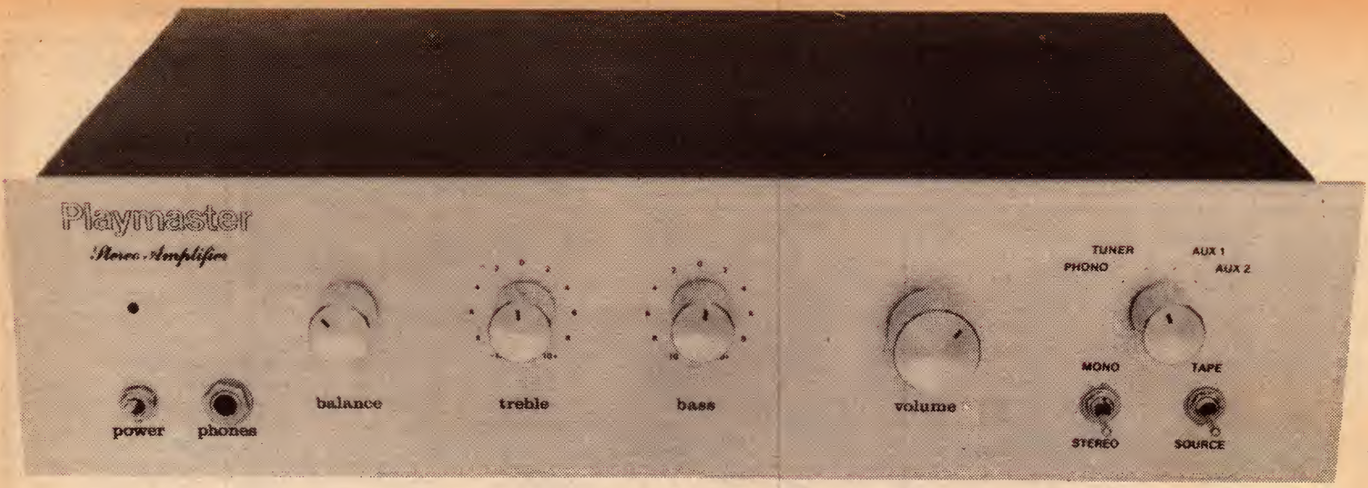
If better temperature stability is required a good trick is to use an ordinary forward-biased silicon diode in series with a 6.2V zener diode (Fig. 6). This makes use of the fact that the forward voltage temperature coefficient of a silicon diode is approximately -2mV/°C. The temperature coefficient of the silicon diode and the zener diode cancel out or compensate each other, giving a reference voltage with a temperature coefficient very close to zero. Alternatively two zeners may be used in series, with equal and opposite temperature coefficients as in Fig. 7.

This gives a much better performance than a standard 10V zener, which has a temperature coefficient of about + 7 mV/°C. In both Fig. 6 and Fig. 7 the two diodes should be mounted close together so that they are at substantially the same temperature.

Several monolitic precision voltage reference ICs are available with typical output voltage temperature coefficients of less than 0.01% /°C change.

These references also usually have a very high degree of precision of the output voltage; however, they usually cost several dollars each. If precision is of secondary importance, and stability is the main criterion, and if the load is constant, then another approach is to use one of the wide range of readily available 3 terminal monolithic voltage regulators, e.g. 7805, 7812, 7815, LM 340, LM 320 etc.

If these regulators are used with a constant and low load of about 10-20mA, then they will also have a temperature coefficient of about 0.01% /°C, while the output voltage variation is about 0.25% of any variation of the unstabilised input voltage. This represents a very cost effective alternative. No heat sinks are needed in this mode of operation, and a wide range of voltages from 5V to 24V is obtainable.



A Playmaster Amplifier for flats and home units

Second article gives the construction details

Last month we introduced our new Playmaster Twin Ten stereo amplifier, explaining the basic design concept and discussing the circuit details of the input and control stages. In this issue, we cover the power stages and present the remainder of the constructional information.

by RON De JONG

The configuration of the output stage is well established for amplifiers of modest power and uses no more components than is necessary for good design.

The output transistors TIP31 and TIP32 are arranged in complementary symmetry. They are driven by a class-A stage composed primarily of a BD140 transistor and four 180-ohm resistors in series-parallel as its collector load circuit.

The particular transistors in each channel — driver and output pair — are of flat plastic pack construction, intended for direct attachment to a heat sink. We mounted them underneath the PC board in such a way that they could be bolted directly to the chassis base. Accordingly, the transistor leads are bent upwards and soldered to the track side of the board.

The arrangement is simple and economical and has the advantage that the PC board can be removed from the chassis without having to unsolder the power transistors — an important consideration should access for servicing be required.

Comparison with the output stage of the Twin 40 shows that, whereas a constant current load was used for the driver in the Twin 40, a bootstrapped arrangement is employed here. Besides using one less transistor, in line with the basic philosphy of this amplifier, the available supply voltage is utilised to better advantage.

The role of the 220uF boostrapping capacitor deserves special mention.

Under quiescent conditions, the minus side of the capacitor is at chassis potential, while the plus side is at about +10V DC. The value of the capacitor is such that it tends to maintain this charge, even under full signal conditions.

During one half of the output cycle, the output stage emitters will fall from an approximate 20V (quiescent) towards 0V, thereby cycling the voltage at the loudspeaker output terminal from 0V towards -20V. At the same time, the bootstrapping capacitor will cycle the junction of the 180-ohm resistors from +10V towards -10V, thereby extending the effective supply to the driver and augmenting the available voltage drive to the TIP32.

If the output transistors were to operate from a true zero ambient current condition, "switching" or "crossover" distortion would assume major proportions. In practice, it is normaly to arrange the bias so that both output transistors draw a small amount of current under no-signal conditions. With drive, and on the respective half-cycles, one transistor is driven towards saturation, while the other passes into full cut-off.

To be pedantic, one should really describe the condition as "class AB".

Estimated cost

We estimate that the current cost of parts for this project is approximately

$85

This includes sales tax.

Not surprisingly, crossover distortion tends to fall as the quiescent current is increased — but at a price: higher average dissipation in both the output transistors and the power supply. The designer must therefore aim for a value of quiescent current which represents an acceptable trade-off between distortion and power dissipation.

In a complementary configuration, as here, the two output transistors take their signal drive from a common source but, to meet the foregoing bias requirement, each base must be referenced to a DC potential slightly positive or negative with respect to the common emitter potential. This means that they must be separated by a resistor or network such that each can assume its own required bias.

A purely resistive network is seldom favoured because the critical bias voltage may vary with supply. Again, it offers no easy way of countering possible "runaway" if high ambient temperature causes the output transistors to draw more current than they should.

It is for this reason that such bias networks often include one or more diodes between the two bases: Not only do diodes afford a measure of regulation but, in reacting to high ambient temperature, they can reduce bias and counter possible output stage runaway.

In the Twin Ten, we have taken the further step of bridging the bases of the output pair with a transistor (Q10), exactly as in the two earlier amplifiers. In this configuration the biasing transistor is often referred to as an "amplified diode" but we prefer the term "Vbe multiplier" as being rather more descriptive of its role.

The transistor configuration has the merits of the diodes mentioned earlier but, in addition, the collector/emitter voltage drop can be varied by means of the 100-ohm pot in the base circuit. This, of course, represents the voltage between the bases of the output pair, so that the 100-ohm preset pot provides a ready means of setting the quiescent current.

Ahead of the class-A driver is a BC549 voltage amplifier (Q6), with the input signal fed to its base and feedback to its emitter.

Because the stages are DC coupled with overall DC feedback, the bias applied to the base of the BC549 determines the mean potential at which its own emitter will stabilise, along with that of the bias network and the emitters of the output stage. In fact, the input bias network (100k, 100k and 220k) was selected with the aid of a CRO for symmetrical clipping and maximum power output. You can verify the choice if you want to but, in practice, and with the use of 5% resistors, voltages should work out closely enough, without further ado.

Incidentally, the 47uF capacitor between the two 100k bias resistors provides essential decoupling to minimise hum injection into the base of the Q6. The capacitor must be rated to operate at more than 30V and must not be old or leaky, otherwise it will upset the bias levels.

Overall gain of the power amplifier is set by the ratio of the two emitter resistors connected to Q6. For the values specified, 1.5k and 150 ohms, the gain is about 11.

To ensure stability of the amplifier at supersonic frequencies, a 180pF capacitor was added between the emitters of Q6 and Q7. In addition, there is a "Zobel" R/C network across the output and an L/R combination to help cope with the highly reactive nature of typical loudspeaker loads.

Headphone sockets have also been provided as in the Twin 25 and Twin 40 but the resistors in series with the headphones have been decreased from 330 ohms to 220 ohms to provide a higher proportion of the available power. The sound level with headphones, in fact, subjectively approaches the author's threshold of pain and should satisfy even the most masochistic pop music enthusiast!

As stated earlier, the power output into loudspeakers is about 10W per channel continuous, or 12W on intermittent music peaks. This can sound very loud indeed if fed into loudspeakers of medium (or better) efficiency. Low efficiency loudspeakers

Performance of prototype

POWER OUTPUT

	One channel	Both channels
4 ohms	8W	7W
8 ohms	12W	10W
16 ohms	8W	7W

FREQUENCY RESPONSE

Phono inputs	RIAA equalisation within 1dB from 30Hz to 20kHz
High level inputs	30Hz to 30kHz ±1dB

CHANNEL SEPARATION

(with respect to 8W into 8 ohms)
1kHz -51dB; 10kHz -43dB

INPUT SENSITIVITY

Photo (1kHz)	2.8mV
Overload at 1kHz (.4% distorition)	150mV
High levels inputs	115mV

HUM & NOISE

(with respect to 10mV)

Phono	68dB unweighted
High level inputs	68dB unweighted with 4.7k input load

TOTAL HARMONIC DISTORTION

(Both channels driven into 8 ohms)
1kHz: 0.14% at 1W; 0.3% at 4W; 1.5% at 10W.

TONE CONTROLS

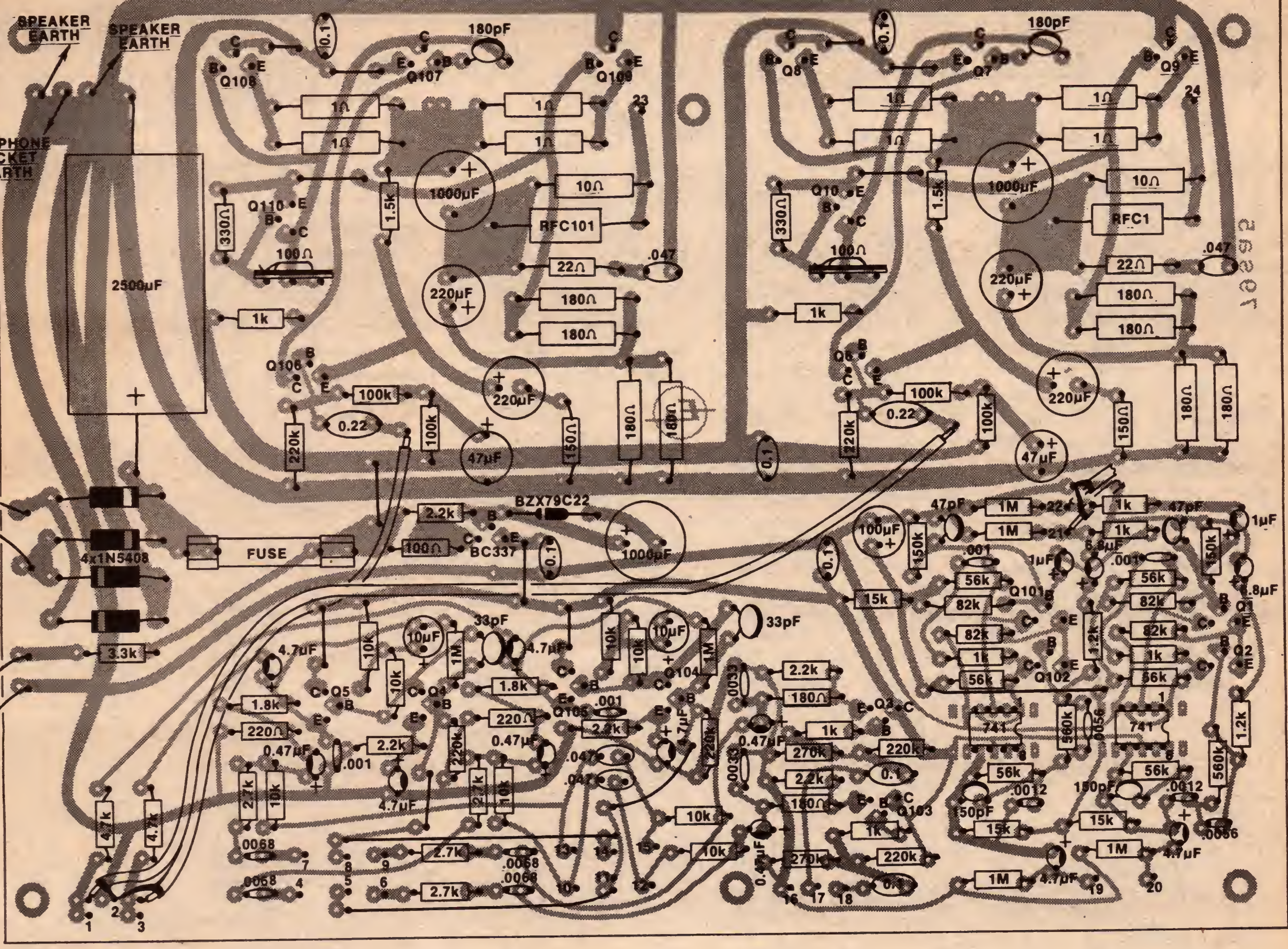
Bass	±12, -13dB at 50Hz
Treble	±13dB at 10kHz

DAMPING FACTOR

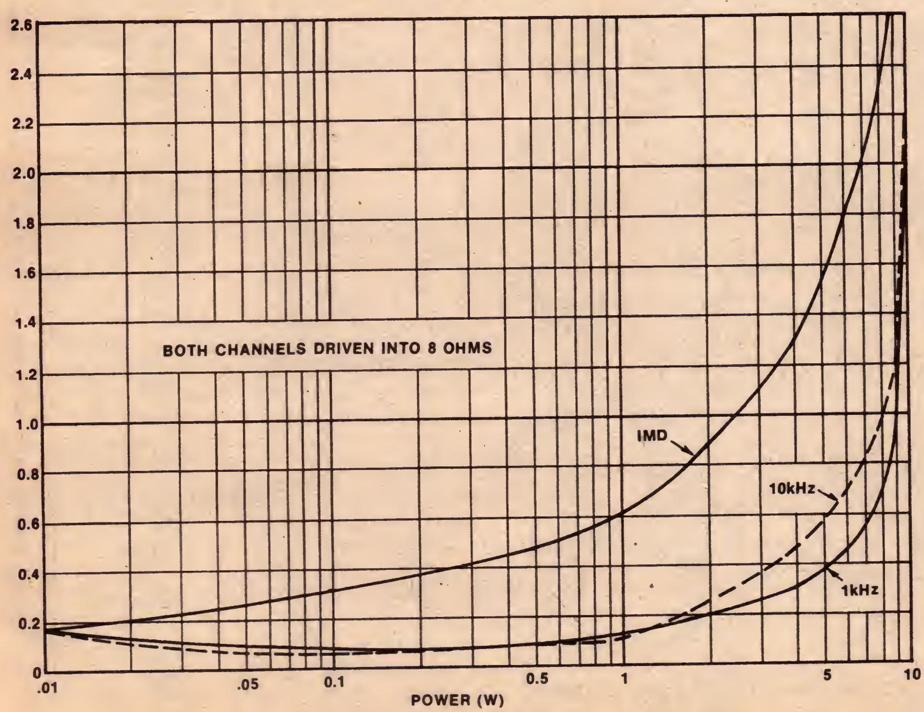
at 1kHz	24
at 50Hz	8

STABILITY

Unconditional



The PC board layout for the Playmaster Twin 10 amplifier. Exercise care when inserting polarised components.



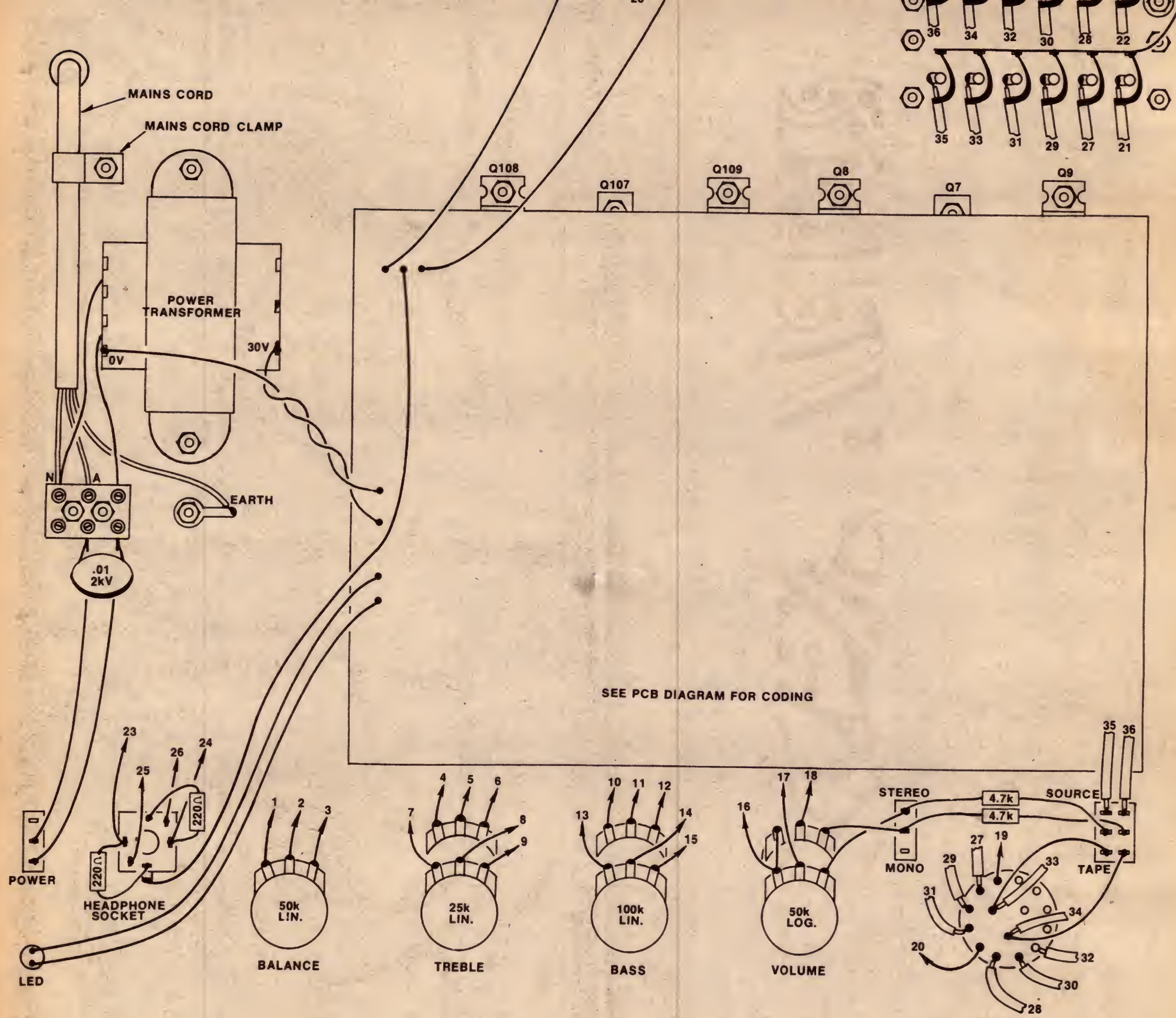
This shows harmonic distortion at 1kHz & 10kHz, also intermodulation distortion.

intended for high-powered amplifiers would not be a good choice.

As indicated by the accompanying curves, the harmonic distortion at typical listening levels is likely to be around 0.1%, which would be well below the level likely to be imposed by the program source and peripheral equipment. In fact, it is not all that long since "point one" was a target for the world's big-name amplifiers!

Looking now to a few general features of the amplifier, inspection of the PC board layout will indicate that three separate earth conductors have been used: one each to the low level stages, the input stage to the power amplifier, and to the output transistors. This precaution minimises common earth paths, and hence the possibility of interstage feedback and ripple injection.

For similar reasons, the circuitry is earthed to the chassis at one point only, namely at the phono inputs. Since the headphone jack has to be connected to the PC board earth system, it should be insulated from the chassis metalwork



Use this diagram in conjunction with the PCB layout to complete the amplifier wiring.

with appropriate plastic washers. If these cannot be obtained, cut a suitable thickness of plastic sheet to shape and wrap the bush of the headphone socket with insulating tape.

Although two 1 ohm 1W resistors have been specified for the emitter resistors of the power transistors, holes are provided on the PC board for single .47ohm higher wattage resistors if these are more convenient.

The choke referred to as RFC1 in the circuit diagram is constructed by winding one and a half turns of insulated wire on a 13mm balun core. Use normal hookup wire for the choke and bring the leads out on either side, as in the photograph.

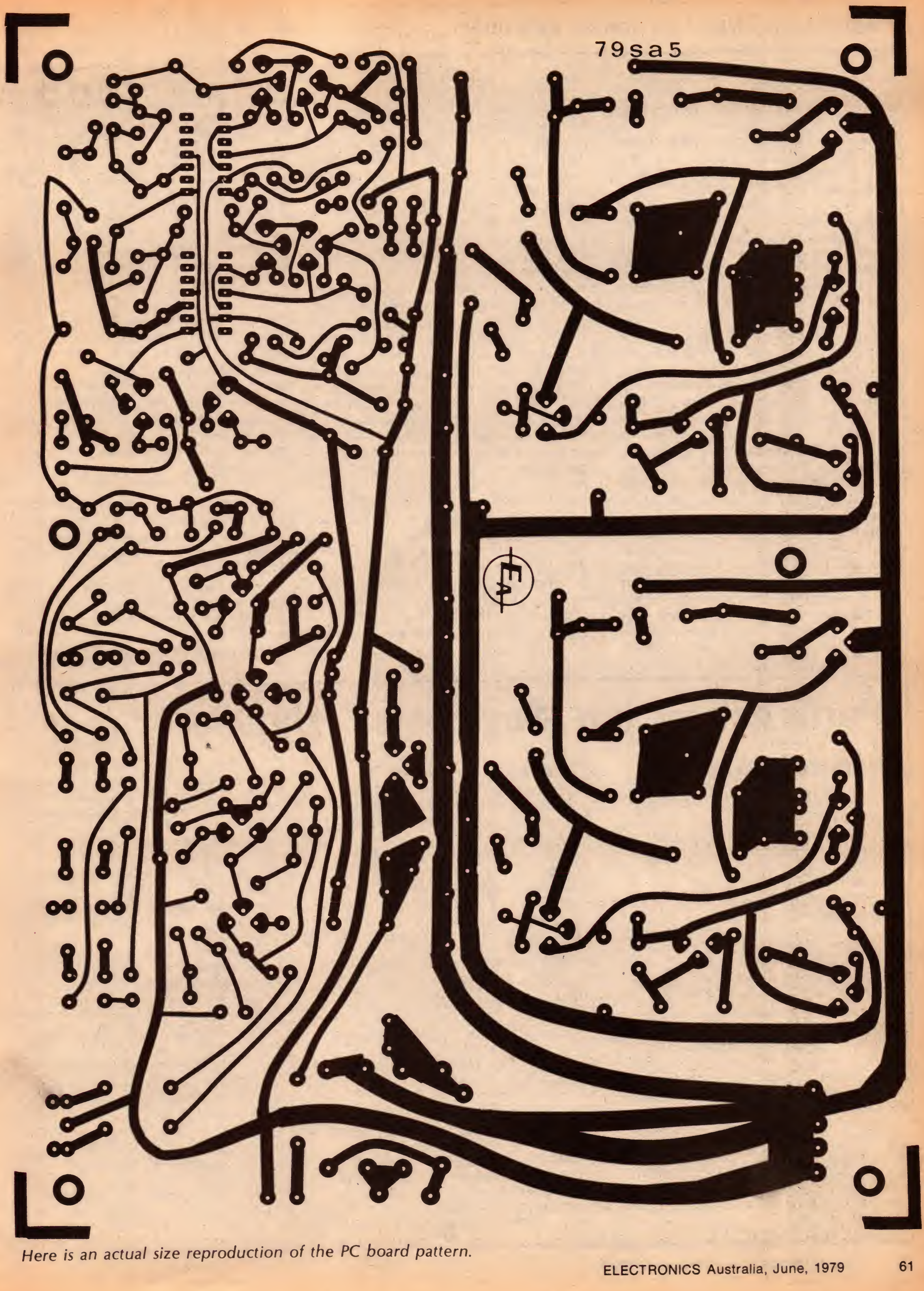
Construction should begin by mounting all components on the PC board. Particular attention should be paid to connecting the tantalum and electrolytic capacitors with the correct polarity (refer to the component overlay or the circuit diagram).

Mounting the transistors should present no special problem, unless you get involved with equivalent types. In this case, double-check the connections before wiring them into circuit.

The power diodes must also be oriented, so check these carefully. If you are still unsure "fire up" the power supply with the fuse and electrolytic removed to check the polarity of the DC output.

Next solder the power and driver transistors to the PC board. These should be oriented so their metal faces come into contact with the chassis when the board is mounted. Bend the leads up about 2mm from the body and insert them through their respective holes in the PC board so that the leads just emerge from the top of the board; solder only one of each of the transistor leads.

Insert the board supports in the holes provided on the PC board, then manipulate the transistors so that their metal faces are all at the same level as the base of the plastic supports and the mounting holes of the transistors are aligned wilth those on the chassis. Mount the board temporarily on the chassis to check that the transistors are properly positioned and, if all is well,



Here is an actual size reproduction of the PC board pattern.

solder the remaining leads to hold the transistors firmly in place.

The next step is to attach leads to the board for ultimate connection to the tone controls, transformer and loudspeaker output terminals.

The lead to the tone controls should be kept as short as possible and "rainbow" cable is recommended both for a neater appearance and to aid lead identification. The use of PC stakes is also recommended, since this permits wires to be reconnected without lifting the whole board.

After all the external leads have been attached, insert the board and its board supports into the chassis and prepare to anchor the driver and output transistors. This should be done by first sticking the TO-220 mica washers in place with silicone grease if this is available. Then push the insulating bushes through the mounting holes on the chassis and the transistor. (Note that no insulating bushes are required to mount the BD140 transistors).

Hopefully the power transistors should be isolated from the chassis, but don't take it for granted. Check by disconnecting the phono inputs from the chassis and testing with a multimeter for continuity between the chassis and any part of the circuitry. If a short is discovered, unbolt the transistors one at a time until the short is removed; then take appropriate action.

Before wiring up the spring loaded speaker sockets, swap two of the terminals around so that the two active (red) terminals are in the middle. This reduces the risk of accidental shorts to earth and facilitates the connection of the .047uF capacitors between speaker earths and chassis via the lugs attached to the mounting screws.

It was mentioned earlier that the headphone socket must be insulated from the chassis so, before connecting the earth lead to the socket, check that it is in fact insulated by using a multimeter or other continuity checker.

Add the mains wiring and check that every thing is complete except for the shielded cabling to the selector switch. Now the amplifier can be readied for switch-on and setting of the output stage quiescent current. Centre the tone controls, turn the volume pot right off and adjust both 100-ohm preset pots so that the BC547 collectors are shorted directly to base.

The optimum current is about 30mA. If you have an accurate millivoltmeter on hand, connect it between the emitters of the respective output pairs and adjust the relevant trim pots until there is a voltage drop of 30mV across the 1 ohm circuit.

Alternatively, cut the link in the collector lead of each TIP31 and bridge it with a milliammeter. Adjust the trimpot for a reading of 30mA.

Yet again, a 100 ohm resistor can be inserted temporarily in place of the link and the current adjusted to produce a drop of 3 volts across 100 ohms.

There is a tendency for the quiescent current to drift after being set but this is quite normal and is nothing to worry about provided the current stays within reasonable limits. Check the current again after the amplifier has been operated for 10 minutes with the lid on. If the current is now above 50 milliamps, reduce it back to 30 and leave it.

If your amplifier doesn't work, note that there are two links provided on the board which allow the supply voltage to the pre-amp, tone controls and the power stage to be independently disconnected. With the power to the output stage removed, the board need not be mounted to the chassis, so the pre-amp and tone controls can be checked through without the danger of the output transistors overheating.

Note also that the voltages provided on the circuit diagram are only nominal and that the actual voltages measured in your amplifier need only be within about 10%.

When correct operation of the amplifier has been verified, the shielded cables to the tuner auxiliary inputs and tape should be connected. To achieve a neater appearance bind the

Parts list for the Playmaster amplifier

CHASSIS & HARDWARE

1 transformer A&R 6672, Dick Smith M-6672
1 plated steel chassis 370 x 80 x 245mm (W x H x D) with cover
1 front panel
5 knobs to suit front panel
2 miniature SPST toggle switches
1 miniature DPDT toggle switch
1 6.5mm stereo jack socket with switch contacts
1 LED for pilot light
2 6-way RCA socket panels, Ralmar M421 or equivalent
1 4-way spring loaded terminal panel, Ralmar ST3 or equivalent
1 rotary 2-pole, 4 position switch
1 100k (lin) dual ganged potentiometer
1 50k (log) dual ganged potentiometer
1 50k (lin) potentiometer
1 25k (lin) dual ganged potentiometer
2 100 ohm large vertical trim pots
6 Richo CBS-6N PC board supports
4 rubber feet
8 solder lugs
1 mains cord clamp and grommet
1 3 way insulated terminal block
1 three pin mains plug and three core mains cable
1 metre of 10 conductor rainbow cable
2 metres of figure-8 shielded cable
6 sets of TO-220 mounting hardware, ie, mica washers, insulating bushes, plus screws and nuts
2 .047uF/100VW ceramic or polyester capacitors
1 .01uF 1kV ceramic
1 PC board, 79sa5
2 fuseclips, Swan (McMurdo) FC1 Part No. 1397-01-18
1 1.5 amp 3AG fuses
2 13mm balun cores

PRINTED CIRCUIT BOARD

SEMICONDUCTORS

4 IN5408 or 100PIV 2 amp silicon diodes
1 BZX79/C22 zener diode
2 TIP31 silicon power transistors
2 TIP32 silicon power transistors
2 BD140 silicon power transistors
12 BC549, BC184 NPN low noise transistors
1 BC337 NPN transistor
2 BC547, BC107, BC182 NPN transistors
2 uA741 op amp ICs

CAPACITORS

1 2500uF/50VW pigtail electrolytic
3 1000uF/25VW PC electrolytic
2 100uF 25VW PC electrolytic
4 220uF 25VW PC electrolytic
2 47uF/35VW PC electrolytic
2 10uF/25VW tantalum electrolytic
2 6.8uF/25VW tantalum electrolytic
6 4.7uF/25VW tantalum electrolytic
2 1uF/25VW tantalum electrolytic
4 0.47uF/25VW tantalum electrolytic
2 0.22uF metallised polyester
7 0.1uF/60VW metallised polyester (greencap) or ceramic
4 .047uF metallised polyester
4 .0068uF metallised polyster
2 .0056uF metallised polyester
2 .0033uF metallised polyester

Special points to watch

- ☆ transistor lead configuration
- ☆ insulation of the output transistors from chassis
- ☆ single point earthing at the point specified
- ☆ insulation of the headphone socket
- ☆ setting up procedure

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cables together with cable ties, or if this is unavailable lace the cables together with ordinary hookup wire.

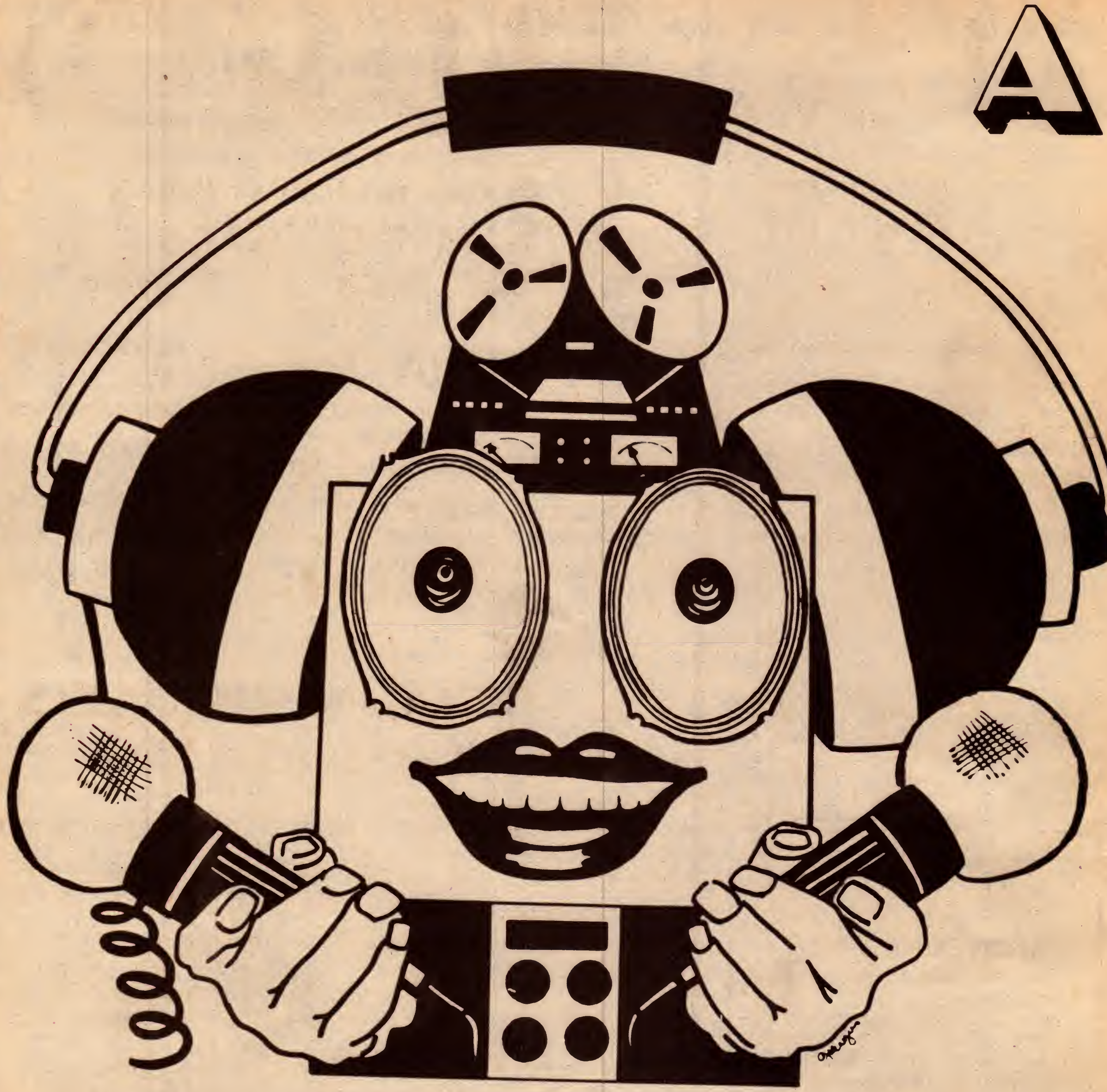
In use, and operating with no signal or at very low volume, the amplifier base will become merely warm to the touch. If it becomes hot under these conditions, there would be clearly something amiss, with the chance that the quiescent current has been inadvertently set too high. With protracted high level operation, the chassis will become noticeably warmer but certainly not such as to be described as "hot".

But there it is: having listened at some length to the prototype, both in the laboratory and in the home, one can only say that its performance completely belies its modest power rating.

2 .0012uF metallised polyester or polystyrene
4 .001uF metallised polyester or polystyrene
2 180pF ceramic or polystyrene
2 150pF ceramic or polystyrene
2 47pF ceramic or polystyrene
2 33pF ceramic or polystyrene

RESISTORS
(5% tolerance ¼W, unless otherwise noted) 6x 1M, 2 x 560k, 2 x 270k, 6 x 220k, 2 x 150k, 4 x 100k 4 x 82k, 6 x 56k, 8 x 10k, 4 x 4.7k, 1 x 3.3k, 4 x 2.7k, 5 x 2.2k, 2 x 1.8k, 2 x 1.5k, 2 x 1.2k, 8 x 1k, 2 x 330 ohms, 4 x 220 ohms, 2 x 180 ohms, 2 x 150 ohms, 2 x 100 ohms, 2 x 22 ohms 1W, 8 x 180 ohms 1W, 2 x 10 ohms 1¼, 8 x 1 ohm 1W, or 4 x 0.47 ohm 5W.

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Where voltage ratings are not quoted, they should be 50V or more. Components with higher ratings may also be used provided they are physically compatible.



Audio Shows 79

PRACTICAL ELECTRONICS

Solder, fluxes, irons — and how to use them

The art of soldering has been part of what we now call electronics since the early days and looks like being around for a long time yet. It presents a minor hurdle for the beginner, but one which must be tackled. This article points out the major pitfalls and discusses the practical requirements for good soldered joints.

by PHILIP WATSON

Nobody gets very far in practical electronics before encountering the need to make soldered joints. While it is possible to get by with screw terminals, clips, twisted wires, etc for elementary — or temporary — projects, anything which is intended to be at all permanent really calls for soldered joints.

The reason is not difficult to understand. A properly made soldered joint comes about as close to a perfect electrical connection as we can get. It provides a low resistance connection between the two conductors, and one which should not deteriorate due to oxidation, as can happen with mechanical joints.

Soldering also offers good mechanical strength, often comparable with that of the conductors themselves, and at least adequate for most ordinary situations.

But note that we referred to a "properly made" soldered joint. Good joints don't just happen; they call for a certain amount of skill. Not a lot, and nothing to get hung up about, but it does involve some effort on the part of the student, and guidance from someone with more experience.

Which leads us to another important point: even though it may appear, superficially, to be normal, a poorly executed solder joint can cause a lot of trouble in service. (Ask anyone who has ever had to track down a "dry" joint in a piece of electronic equipment!)

While we would be the first to admit that the practical skill required cannot be learnt from a book, we can at least put the beginner on the right track. After that he — or you — will have to learn by doing.

A formal definition of soldering might read thus: "The use of a low temperature molten alloy, flowing over the surfaces to be joined, and adhering to them, a flux being used to assist the adhesion." That is accurate enough as far as it goes.

It is not our intention to delve deeply into the "chemistry" of soldering. This has been done in many other articles, including those in this magazine in November 1962 and January 1963. Our aim here is put the reader on the right track regarding essentially practical requirements.

In a properly made soldered joint the solder will adhere to the metal with exceptional tenacity. It cannot be prised loose, nor can it be drained off by heating. The structure of the bond is quite complex but it is important to know what constitutes a good joint.

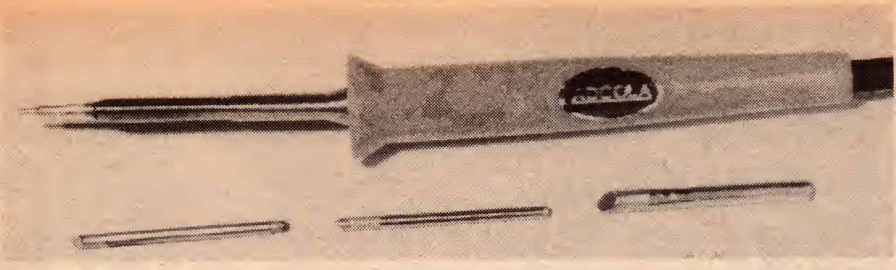
There are two basic requirements:

(1) The metal surfaces must be clean and free from oxides.

(2) The temperature of the metal surfaces must be raised to that of the molten solder.

When these requirements are satisfied the molten solder will "wet" the metal surfaces and flow freely over them. The ability to recognise the "wetting" action is part of the skill to be learned. Also, from the "wetting" concept comes an opposite term: a "dry" joint. It implies that the solder has failed

Solder comes in many forms and grades but, for electronics work, the wire form, with mutiple flux cores, is virtually standard. At left is a fine gauge, 0.71mm, and at right the more common 1.6mm gauge. Both are 250g reels.



Typical of modern soldering irons suitable for the beginner is this "Adcola" 240V, 12W unit. As well as the fine tip shown fitted to the iron there are three more tips displayed, intended for heavier jobs.

to wet the metal and therefore has not adhered to it.

Consider first the cleaning: in heavier applications, such as plumbing, it is customary to use files, wire brushes, glass paper, emery paper etc. In electronics, we can usually regard the surfaces as being basically clean as we receive them, since most terminals and wires are tin plated. However, bare copper wire may need to be scraped with a sharp edge or rubbed with glass paper to remove surface oxide.

Unfortunately, no matter how clean the surfaces are initially, they will not stay that way for very long when we start soldering. The act of raising their temperature to that of molten solder tends immediately to create an oxide coating, thus inhibiting the solder bond.

This brings us to the subject of fluxes. What might be termed the primary function of a flux is to provide a protective coating over the surfaces while they are being heated, to exclude the air and prevent the formation of oxides.

Petroleum oils, jellies, or waxes will perform this function and can serve as fluxes in ideal circumstances; they are seledom used in practice, however. The truth is that most surfaces, no matter how bright they might appear, are oxidised to some extent, so that practical fluxes need to provide a secondary function, that of dissolving residual oxides.

Acids as fluxes

Many acids will perform this function very well at, or below, typical soldering temperatures and so we find that most fluxes consist of or contain acid to a greater or lesser extent. These may range all the way from hydrochloric acid (spirits of salts) used by plumbers on galvanised iron to pure rosin for electronic work.

The problem with acid fluxes is that most acids are corrosive and any flux residue left after soldering can continue to attack the surrounding metal, particularly under conditions of high temperature and high humidity. This is not much of problem for the plumber, who can slosh a bucket of water over the job and wash away the residue, but it can be a serious problem in electronics.

Corrosion in electronic equipment simply cannot be tolerated, particularly where fine wires are concerned, as in coils. It can eat away such wires, rendering the equipment useless.

It is for this reason that a lot of care has gone into the development of "non-corrosive" fluxes for the electronics industry, and also why the range of suitable fluxes is rather restricted.

For many years rosin was the standard and almost exclusive flux used in electronic equipment, usually in the form of a core in thin wire solder. Rosin releases an acid (abietic acid) at typical soldering temperatures, but becomes inert again when it cools.

But pure rosin is still not the ideal flux. Where individual components have more than a certain amount of oxide coating and/or are contaminated with other foreign matter, rosin is not equal to the task. The result is a dry joint and, in mass production, it is inevitable that a percentage of these will not be recognised by the operators, or during subsequent inspection, and will go into the field. Sometime later they appear as intermittent faults.

This led to the development of activated fluxes; rosin fluxes to which are added small quantities of chemicals which release an acid vapour when heated and which makes for a much more effective flux. They are still regarded as "non-corrosive" because most of the chemical acid is vapourised and any that remains is rendered inert by the solidified rosin. This forms a hard glossy surface over the metal and protects it from any atmospheric moisture which might activate residual chemicals. In practice, they work extremely well.

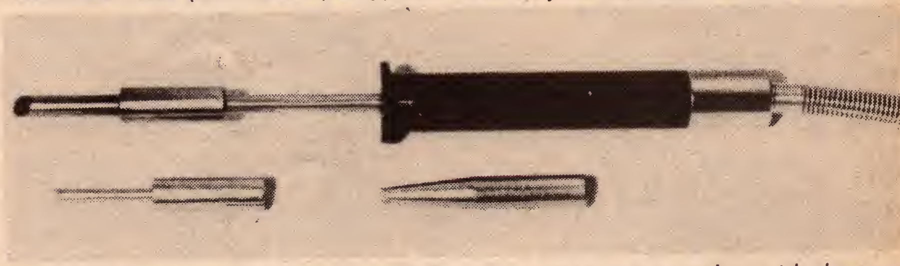
This brings us to basic requirement (2) which we listed earlier: that the temperature of the metal surfaces must be raised to that of the molten solder.

We normally melt the solder onto a joint by means of a hot copper bit, "tinned" with a coating of solder, and which is the business end of a complete implement commonly called a soldering iron.

The need to raise the temperature of the metal surfaces to that of molten solder should be obvious. The solder cannot remain molten while it is in contact with a metal surface at a lower temperature. Even if the main body of solder remains molten because it is in contact with the bit, there will be a thin layer against the cooler metal which will become solid.

"some authorities advocate . . ."

So important is this requirement, that some authorities advocate that the solder should never be applied to the bit, the bit being used only to heat the metal to the point where it (the metal) will melt the solder when it is applied. In this way the operator can be sure that the metal is hot enough, since it will not melt the solder otherwise.



Typical of low voltage irons is this "Mico" 12V, 10W unit, together with three of the most commonly used tips. Although requiring a transformer, many people prefer the smaller, lighter irons available in the lower voltage types.

The theory behind this is sound enough, and it is often applied in practice, particularly in heavier duty applications, such as plumbing. "Yorkshire" fittings are a typical example, where a flame is used to heat the metal pieces until they melt the built-in solder ring, which then flows and completes the joint.

Conflicting requirements

Unfortunately, it is not quite that simple in the electronics field. A conflicting requirement here is to protect adjacent components and materials from excessive heat, while still ensuring that adequate heat is applied to the actual joint. To apply the aforementioned technique is to risk taking so long to complete the job that other components may be damaged.

One reason is the difficulty of making good thermal contact between the bit and the work, particularly as the latter may be irregular in shape. By flowing a little solder between the bit and the work, we use the solder to conduct the

Solder, fluxes, etc.

heat to a much larger area than can be reached by the surface of the bit alone.

This heats the metal quickly and, when it is hot enough, the solder will wet it and flow freely over the surface. Recognising this condition is part of the skill of soldering. A classic mistake is to observe that the solder flows freely over, say, a solder lug, but to neglect to check that it also flows correctly over the wire passing through the lug. The result is a wire passing through a hole in the solder, but completely "dry".

A bad habit, when using cored solder, is to carry molten solder to the job on the tip of the bit. This is a carry-over from situations where the flux is applied separately, before the solder. When using cored solder most, or all, of the flux can be vaporised in the time needed to convey the solder to the job. This applies particularly to the more volatile chemicals used in activated fluxes.

The practical approach

As a result of all the factors we have discussed, most workers follow a fairly standard procedure when making a joint. When using new components, already tinned, it is reasonable to a assume a basic cleanliness; at least to the point where the flux will take care of slight contamination or oxides.

Normally, the bit and the solder is applied to the job at the same time and a little solder melted onto the tip of the bit to aid thermal conductivity between the bit and the job. When the solder flows, more can be applied if the size of the job demands it, preferably to the job rather that the bit.

Although the solder is designed to set quickly, it is important that no movement of the parts should occur during the setting period. If it does, it can produce a faulty joint, similar to a dry joint, at least as far as the end result is concerned.

Where one or more of the parts to be joined are other than bright and shiny, extra care is necessary. The usual procedure is to treat such components separately, before attempting to make a joint. Excessive dirt or oxide is best removed by scraping with either the blade of a knife or fine glass paper, until bright metal is revealed. The surface is then "tinned" with a coating of solder, particular attention being given to the manner is which the solder flows. If any doubt exists the process should be repeated.

The need to make joints quickly is most evident when working on printed boards. Prolonged heating can destroy the bond between the copper and the base material, allowing the copper to lift. On the other hand, the copper pattern normally accepts solder very readily, the boards being sprayed with a protective coating, which is also a flux, while the copper is still bright. As a result, the solder should flow over the copper almost immediately it is applied.

Another factor which helps is that the mass of copper involved in any part of a printed board is very small, therefore reaching the required temperature very quickly. Be aware, however, that this may not apply to the wire being soldered to the pattern; it may form part of a substantial component and so take somewhat longer to heat.

In the event that a printed board joint does not "take" immediately, do not continue to apply heat and try to force the situation. The result will almost certainly be a damaged board. Back off and determine what has gone wrong. If it is a dirty pigtail, for example, clean it and tin it away from the board, before trying again.

So far we have made only passing mention of solder, flux, and the soldering iron, without delving too deeply into the practical form in which these are found. For the beginner, some elaboration is justified.

Electonics grade solder is normally supplied in wire form, with a core, or cores, of activated rosin flux. It is normally a 60/40 tin/lead alloy, the proportion being chosen deliberately because it combines a low melting pont with rapid setting.

"Wire" solder is available in a variety of wire gauges, the most popular in the past being 16SWG or 1.6mm, and 18SWG or 1.25mm. More recently, thinner gauges, such as 22SWG or 0.71mm, have become popular for use with miniature components and, particularly, complex printed board patterns. Such boards often have terminating pads very close together and it is all too easy to apply excessive solder and thus bridge adjacent points. Thinner solder makes the amount applied easier to control.

The 250g reel is a popular size and, although it may look expensive, one reel will last the average hobbyist a long time.

Multiple flux cores

The use of more than one core of flux — five is a popular number — is intended to reduce the risk of no flux being available at a particular point, due to minor breaks in the flux continuity. The reasoning is that it is unlikely that several cores will all suffer a break at the same point.

There is a large variety of soldering irons available; so large that it is beyond the scope of this article to deal with them all in detail. We may do that in a separate article. However, we will give a brief summary of the more usual types.

All are heated electrically and include 240V types for direct connection to the mains, and low voltage types operated from a transformer. Typical power ratings are from 10W to 25W. There are quick-heat types, which are turned on only when a joint is to be made, variable wattage types with manual adjustment, and automatic constant temperature types.

The more elaborate types may be hard to justify at hobby level, and a simple type, of about 15W rating, either 240V or 12V will suit most beginners. The quick heat type is handy in situations where there may be long breaks between joints, as when developing a circuit, but they are rather more expensive, and call for some additional skill in their use.

Care of the bit.

All irons are fitted with a removeable bit, since this will need to be replaced eventually. This also allows a variety of bit shapes and sizes to be used, according to the job requirements. In any case, the bit should be removed at regular intervals and both it and the barrel cleaned of scale. Failure to do so can result in the two becoming "frozen" together, with the chance of the iron being damaged in trying to free them.

The first thing to be done with a new bit is to tin it, by giving it a coat of solder over the working faces. Shape the bit, if necessary, with a file, then allow it to reach working temperature. This will normally cause the formerly bright copper surface to darken with the formation of oxides and may prevent the solder from wetting it, flux notwithstanding. A good idea is to give each face a quick rub with the file, while hot, then apply solder immediately.

In use it is desirable to clean these tinned surfaces if they become oxidised, usually by rubbing with a scrap of cloth. When the tinning shows signs of pitting or breaking up, the faces should be filed down to copper and retinned.

And that about sums up the soldering scene as it is applies to the electronics hobbyist. Having digested all that we have said, it remains to put it into practice. Try making up some simple dummy circuits, but preferably using previously unsoldered pigtails, terminal lugs, etc. A little practice should enable the reader to appreciate the various points we have made throughout this article, and set him on the road to becoming a skilled worker.

But never take this skill for granted. Even the most experienced worker can make a dry joint if he becomes careless — every joint needs to be made with care.

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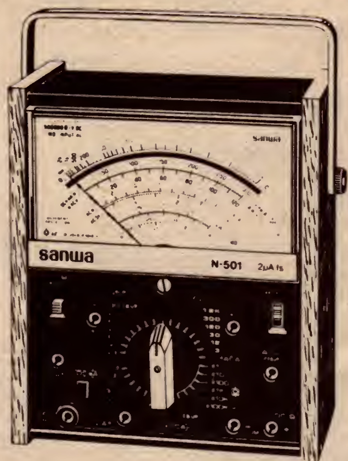

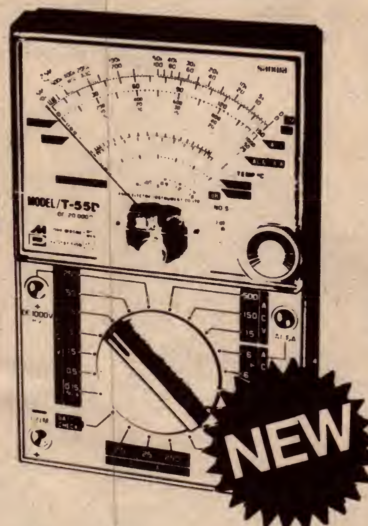

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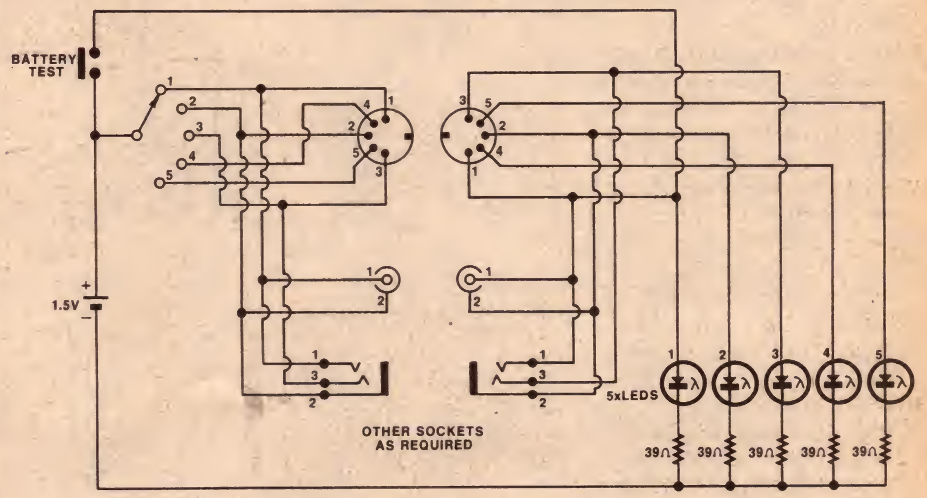
Circuit & Design Ideas

Conducted by Ian Pogson

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Your contributions are welcome, and will be paid for if used.

A comprehensive cable tester



Many of the faults in an audio system are caused by cables. Have you ever tried to find which cable is broken among the many connections in a stage audio system, especially with anxious people looking over your shoulder? One answer is to check each cable before the performance, a rather tedious business.

This cable tester checks not only for continuity and shorts to earth, but also shows up shorts between conductors and transpositions. This last point can be important as some DIN-to-DIN cords have deliberate transpositions. Also, since most cables will have different connectors at each end, with all sorts of custom wiring arrangements, we need to see at a glance which pin is connected to which.

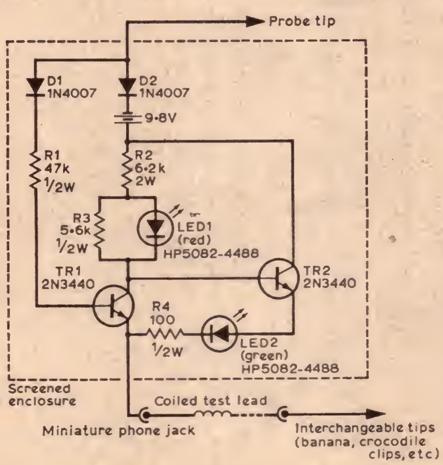
The author has seen a design for a cable tester which does not show up transpositions, only tests for shorts to earth, can only cope with one interconnection scheme between different connectors, uses a mains supply, two transistors, one FET and a TTL IC. It was probably published as a joke. One would hope so anyway.

The design presented here is powered by a single dry cell and needs no power switch since the act of plugging in a cable completes the circuit. The battery test button is operated momentarily before using the device. LED No 1 should light, indicating that the battery is OK.

In operation, the rotary switch is used to select each conductor in turn and the appropriate LED should light. If more than one LED lights, you have a short. If they light in the wrong order, you have a transposition. If none lights, you have an open circuit.

(By Mr G. Leadbeater, 16 Ellison Street, Ringwood, Victoria 3134.)

General-purpose fault-finding probe



This probe may be used as a convenient substitute for the normal multimeter when fault tracing, since it eliminates the need to keep stopping to switch meter ranges etc. It provides an indication of the presence of either AC or DC potentials (indicating which) between 1.5V and about 500V, whether there is continuity between two points and some indication of the resistance between the two points. Of course it does not measure potentials and only gives a rough indication of ohms — but when carrying out quick checks on a piece of equipment this is not necessary, at least during preliminary checks.

The whole unit can be built into a small insulated case, for example the housing of a penlight flashlight, and operated from a miniature mercury battery. For other forms of construction a conventional battery could be used.

When the test leads are placed across two points between which there is continuity but no potential difference, current from the internal battery forward biases TR2 and turns it on. The green LED then lights, but the small base current is not sufficient to cause the red LED to light. The lower the resistance between the two points, the brighter the green LED. If the resistance is more than about 5k neither LED lights. One can use this facility not only to test component and wiring continuity, but also the operation of wipers on potentiometers etc. If the external circuit includes a semiconductor, the green LED lights only when the probe tip is connected to the N-type material, and this provides a further useful test.

Should the probe tip be connected to a point more than about +1.5V with respect to the test lead, the emitter-base junction of TR2 is turned on and the red LED lights, with the green LED staying dark. If neither LED lights, even when the test lead and test probe are interchanged, the two points are either open circuit or have more than 5k resistance between them. If the red LED lights no matter which way round the test lead and test probe are connected, then the potential difference between

the two points must be AC.

A few minutes' practical use with the fault finder is likely to underline its usefulness rather more than this description. The feature that seems really attractive is that the various checks can be carried out quickly, without having to keep fiddling with the range switch of a multimeter.

The test leads should be kept from touching when not in use to prevent drain on the battery. For this reason, the test lead should be made removable although a possible alternative, eliminating the need for the miniature jack and socket, would be to have an insulated cap fitting over the probe tip when not in use.

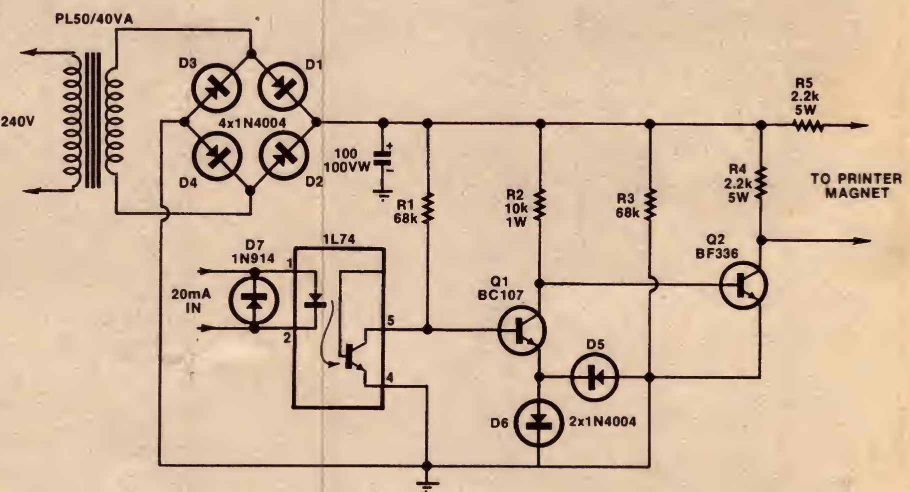
(From "Radio Communication".)

Opto-coupled magnet driver for teleprinters

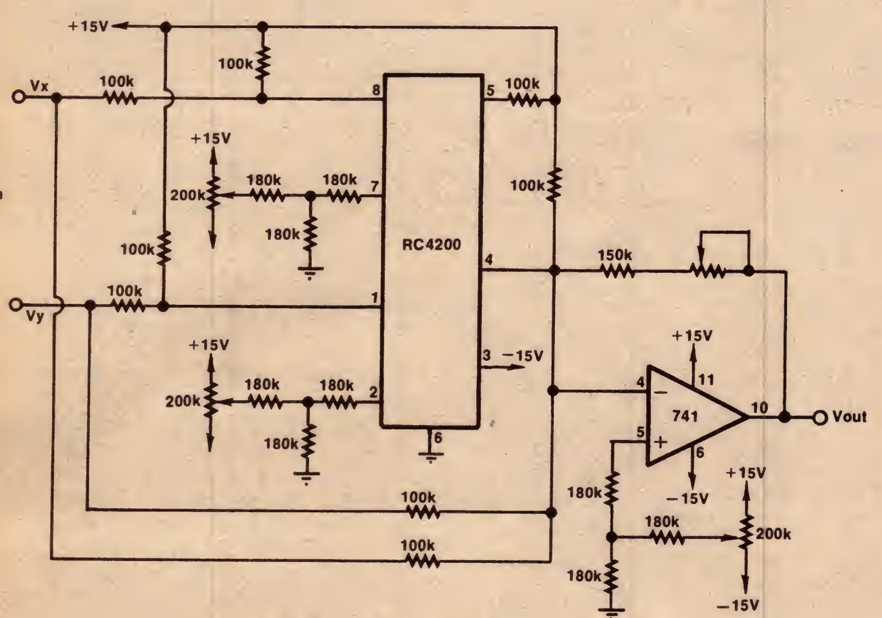
This circuit will drive 30mA through the selector coils of a tele-printer and connects to the 20mA output of a microprocessor board, at the same time avoiding ground loops. Diodes D5 and D6 ensure that Q1 and Q2 can be completely turned off. Resistor R5 sets the current through the printer magnet coil. The value of $Vb + (R4/(R5 \times Vb))$ governs the peak voltage appearing at T2 collector, with a 1:1 ratio then the peak will be 140V. The parallel resistance of R4 and R5 governs the collector current passed by T2.

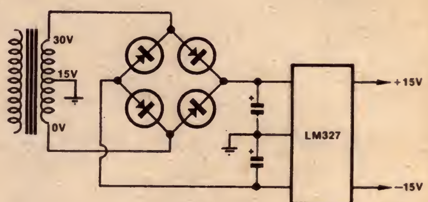
A BF336 transistor was used for Q2 because it was readily available, but any NPN transistor with adequate Vcbo and Ic max could be substituted.

(By Mr W. Gummerson, 13 Hindmarsh Road, Liverpool, NSW 2170.)



Recording DC power using a chart recorder.





If you wish to keep a continuous record of DC power levels using a chart recorder, it is best to plot voltage squared, as power is then given by the area under the graph. In an experiment at Hartley College of Advanced Education, we wanted to record the daily power output of a silicon solar cell. We found that the circuit shown, based on the Raytheon RC4200 multiplying amplifier, was well suited to our requirements.

The following points may be of interest to readers wishing to construct the circuit: the RC4200 chip is very sensitive to voltage drift in the power supply. Our original power supply, using zener diodes, was not stable enough. The 4200 chip is linear only if the offsets on pins 2 and 7 are correctly adjusted. The offsets are easier to set if a 10k potentiometer is connected in series with each 200k potentiometer for fine adjustments. The drift in the circuit is less than 4mV.

(By Messrs R. D. Goodwin and P. Spooner, Hartley College of Advanced Education, 15 Lorne Avenue, Magill, SA 5072.)

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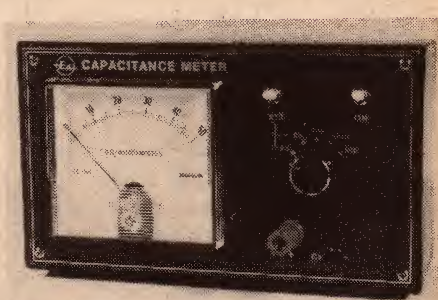
Add inductance ranges to the direct-C meter

With a small amount of additional circuitry, the direct reading capacitance meter discribed in January can be arranged to measure inductance as well. This brief note gives the details.



The original capacitance meter, described in the January 1979 issue. Low in cost, it reads from a few pF to 5uF.

The January 1979 issue of Electronics Australia featured an inexpensive, direct reading capacitance meter operation on the principle of charge storage to determine capacitance. With the addition of a few components plus some component value changes, the same basic meter can be used in a dual role for rapid measurement of inductance as well as capacitance.

The range of inductance measurement is from 3 microhenries to 3 Henries full scale, with a lower measurement limit in the order of 0.1uH set by stray inductance of the test leads. Measurement is possible even in the presence of moderate shunt capacitance or resistance.

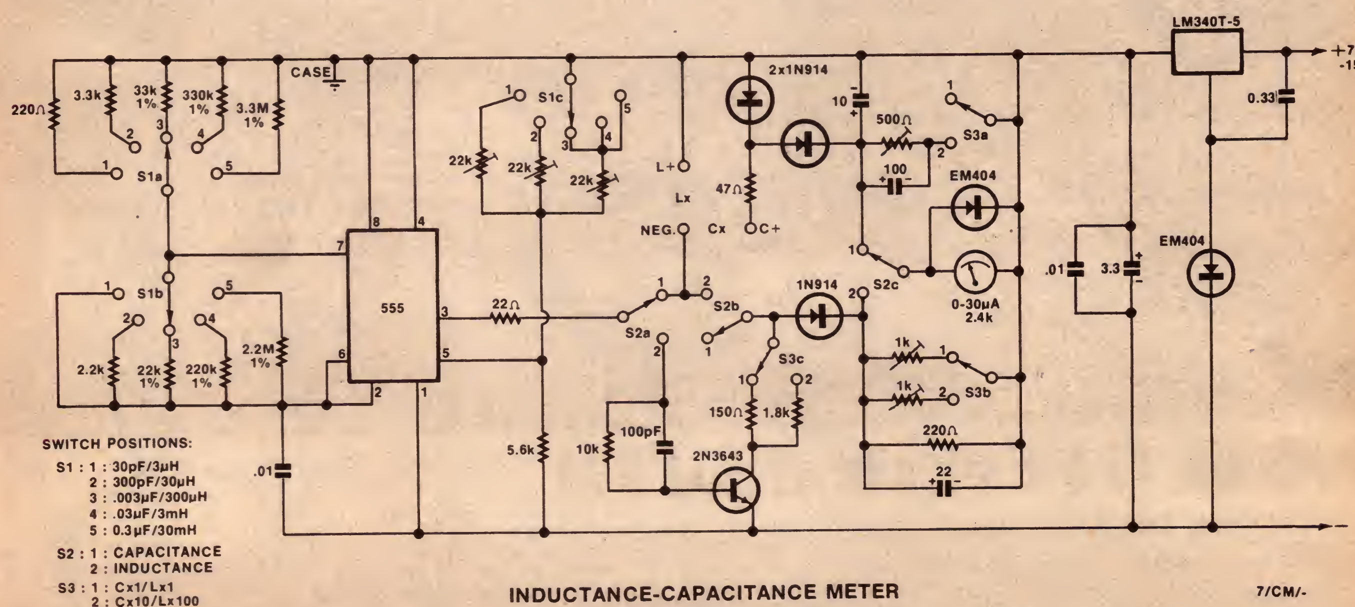
Absolute accuracy of the meter cannot be compared with a precision RF bridge, but speed and convenience make it useful for construction, measurement or comparison of RF chokes, peaking inductors, loudspeaker crossovers, TV coils, IF transformers, audio filters, CRT scanning coils etc. Simplicity, component availability and ease of calibration make the meter suitable for home construction. A variety of meter movements and calibration scales, such as 0-50 uA or 0-100 uA, can be accommodated by appropriate component variations.

In operation, the 555 timer switches the 2N3643 transistor rapidly between the on (saturated) and off states. During the on state, current through the test inductor builds up to a steady-state value determined by the effective series resistance in the collector circuit of the 2N3643. When the 2N3643 is switched rapidly off, decay of the inductor current generates back EMF to force an alternative current path through the 1N914 diode and meter circuit. It can be readily demonstrated that the time-averaged value of this current is directly proportional to the test inductance value.

For normal use, the L x 100 range is employed to minimise errors caused by inductor series (winding) resistance. The L x 1 range is used for very small inductances, or to reduce errors caused by unavoidable shunt capacitance and resistance.

A few brief experiments with a 1mH choke, or a short circuited 2 metre length of TV ribbon, plus a handful of resistors and capacitors to act as parasitic impedances, will soon establish a working familiarity with the meter. With appropriate techniques even magnetising and leakage inductances of gapless ferrite or iron cored transformers can be measured.

You might be able to squeeze the meter into the original case, but it would probably be better to use the next size up.



INDUCTANCE-CAPACITANCE METER

Here is the complete circuit of the expanded meter. Only a handful of additional parts are required.

The Serviceman

The same symptoms, but quite different faults

The fact that identical symptoms do not mean identical faults may cause the layman to believe that he has either been "ripped off" — if the "same" job for someone else was cheaper — or that he is up for an expensive repair; again on the basis of someone else's experience.

This point was brought home rather forcibly by a couple of jobs I handled recently; the symptoms were virtually identical, but the nature of the faults — and the costs to the customers — were about as different as one could imagine.

The first job involved a National 26in set and, according to the owner, the screen was flooded with bright blue light to the point where, according to him, he could see nothing else on the screen. He added that the set seemed to behave normally when first switched on until about a minute after the picture appeared. As it turned out, this was an interesting observation.

There is not much point in trying to chase faults like this in the customer's home, so I brought the set back to the shop. And, while I hoped it wasn't the tube, this is one of the easiest things to check before delving into the works, so I did this first.

According to the tester all three guns showed normal emission, and there were no indications of any internal shorts. Feeling somewhat relieved on the customer's behalf, I was about to disconnect the tester when one of the short indicator lamps suddenly lit up. It was for the blue gun, and indicated a heater to cathode short. Small wonder that the blue gun ran amok, with all the bias removed.

Well that was straightforward enough, but I realised that I had nearly been caught. I hadn't taken sufficient notice of the customers comment regarding the delay after switching on, before the fault appeared. Had I switched the tester off a few seconds earlier I would have imagined the tube was OK and wasted a lot of time checking the rest of the set.

Unfortunately, faults of this kind mean a new tube, and this is never the happiest news to pass on to a customer. In this case I was even less happy, since I knew that the customer wasn't particularly well off.

For a while I pondered on the possibility of using an isolating transformer to allow the heaters to float at the cathode potential. Such an idea is not new and it would certainly solve the problem as far as the DC potentials were involved. Unfortunately, it isn't quite as simple as that. The heater in the faulty gun is now at video potential, along with the cathode, and no matter how it is fed there is bound to be a substantial capacitance between it and chassis; the last thing that can be tolerated in a video circuit.

So, rather reluctantly, I scrubbed the idea. The next best approach was to fit a rebuilt tube rather than a brand new one, and I suggested this to the customer. This put him in something of a quandary; while he was worried about the cost, he didn't altogether trust the rebuilt tube idea — a not uncommon reaction. To help him decide I pointed out that these tubes are completely re-gunned and that the only active part of the tube which remains is the screen; something which experience has shown has a very long life, typically 10 years for average usage.

I went on to say that my own experience with these tubes had been a completely happy one. Quite a number of customers have used them on my recommendation, and I have had no cause to regret it.

I don't know whether that convinced him or not, but the price difference certainly did. A rebuilt tube is only about half the cost of a new one in most cases, and it also carries a new tube guarantee. That clinched it and he gave me the OK to go ahead.

Hardly was that job back in the customer's lounge room before another customer walked into the shop and calmly announced that he had a TV set in which the screen was flooded with green light. Had it been April Fool's day, I would have suspected someone was pulling my leg. But it wasn't, and they weren't, so I did my best to keep a straight face.

At the same time, it would have been understandable had I suggested that he had a faulty tube. I didn't, in spite of the temptation, simply because I don't believe in making snap diagnoses based on guesswork. I have known some who did this, and it can sound very impressive at the time, but it can also rebound in a most embarrassing manner when the guess turns out to be wrong.

On top of that, the picture tube is about the worst thing one can guess at. It is probably the most effective way of convincing the customer that you are setting him up for a rip-off. He is just as likely to decide to "think about it", and that will be last you will see of him.

So, having resisted the temptation for all these good reasons, it rather set me back when I realised that some Job's comforter had already been at work on the customer and virtually convinced him that he would need a new tube. And, with stories of hundreds of dollars for a new tube, he wasn't very happy, particularly as the tube was only just out of warranty.

He wanted to know straight out if it could be the tube. And, of course, I had to answer truthfully that, yes, it could be the tube. But I hastened to add that it could be something else instead; like a faulty colour amplifier transistor.

Then he wanted to know how much it would cost. (I hadn't even seen the set at this stage, or even been told what make it was.) I explained, as briefly as possible, that it was not normally possible to quote for radio or TV repairs. The cost of the repair cannot normally be assessed until the fault is found, by which time a significant proportion of the work will already have been done. Whether I convinced him or not I don't know.

On the other hand there was no point in being deliberately unhelpful. Having determined the make and size of the set — it was a 26in Blaupunkt — I told him that, if he needed a new tube it would cost around $200, plus fitting at the normal hourly rate. If he cared to settle for a rebuilt tube it would cost him a little over $100, plus fitting as before. It is wise to allow a couple of

hours for fitting, even though it can usually be done in less.

As with my previous client, he wasn't too keen about the rebuilt tube idea, at least initially. After I had spelled it out in detail, and he'd thought about the price difference, he seemed more reconciled to the idea.

If it wasn't the tube, then the situation was less clear. I could only quote him the hourly rate I would charge, to which would have to be added the cost of components. Finally, I offered to test the tube for him, at no charge, if he was able to bring the set to the shop. If it turned out not to be the tube he could please himself whether I should proceed.

Rather surprisingly, he jumped at that. Not many people are keen to manhandle a 26in set into a vehicle and out again, but he seemed to think that he could organise it, and that it would be worth it. So we left it at that.

Sorry about that!

In my April notes I referred to an article on high voltage power line interference which appeared in the IREE "Proceedings".

Unfortunately I quoted two issues; November and December 1978. This has caused some problems for the IREE, particularly as the reference created considerable interest.

To set the record straight, the correct issue was DECEMBER, 1978.

Sure enough, a couple of days later his car pulled up outside and he and a friend manhandled the set into the shop. He wasn't able to wait while I tested the tube, but gave me a phone number to call when I had checked it. However, I did establish the vital piece of information that the fault did not normally show up until the set had been running for about 10 minutes. Remembering the previous job, I was glad I asked.

So I connected the tube to the tester and checked each gun for shorts and emission. Initially, at least, I could find nothing wrong, so I left the tester connected and the tube heaters running for the next 15 minutes or so. When nothing showed up in that time I re-connected the tube to the set and switched on.

As I expected, the picture came up normally and ran that way for the next 10 minutes or so then, just as the customer had said, there was a green background and faint retrace lines. There was still a picture from the two remaining guns, but with distorted colour values.

At this point I considered that the green colour amplifier was the most likely culprit and, in the ordinary way, would have made some voltage measurements at emitter, base, and collector. But not so with the Blaupunkt. The colour board carrying these amplifiers is mounted hard against another board in such a way that it is impossible to get at these points. (It might be a nice set, but I wish the design engineers would think of the serviceman sometimes.)

The next best thing was to pull the board out and see if I could find anything with the ohmmeter. In particular, I measured between base and emitter and base and collector of the green amplifier, hoping to find either a short circuit or open circuit. In fact, there was no sign of either and, as far as this simple test was concerned the transistor was OK. Nor could I find any other faulty components in the green section.

So I replaced the board, switched on, and waited for the green to show up again. It did so after about five minutes and I deliberately let it run for the next couple of hours. During this time the green became progressively stronger, until it eventually wiped out the image from the remaining guns. As a check I disconnected the green lead from the tube, whereupon the red and blue images reappeared.

But that was by the way. What I really wanted was to get my meter prods on the board while it was good and hot. So, with everything at the ready, I whipped the board out and jabbed the prods between base and emitter of the green amplifier. It read open circuit. I moved one prod over to the collector and found that the base to collector was also open circuit.

"Gotcha, you beauty!"

From then on it was plain sailing. A new transistor was fitted and the set left running for the rest of the day, and for a couple more hours the next morning. With no sign of trouble I rang the owner and told him he could collect it any time he liked.

Naturally he was very happy, and even happier when I answered his tentative query about the cost. Since he had handled the transport of the set I had charged for one hour's labour, plus a dollar and something for the transistor — a tiny fraction of what he had feared when he suspected the picture tube.

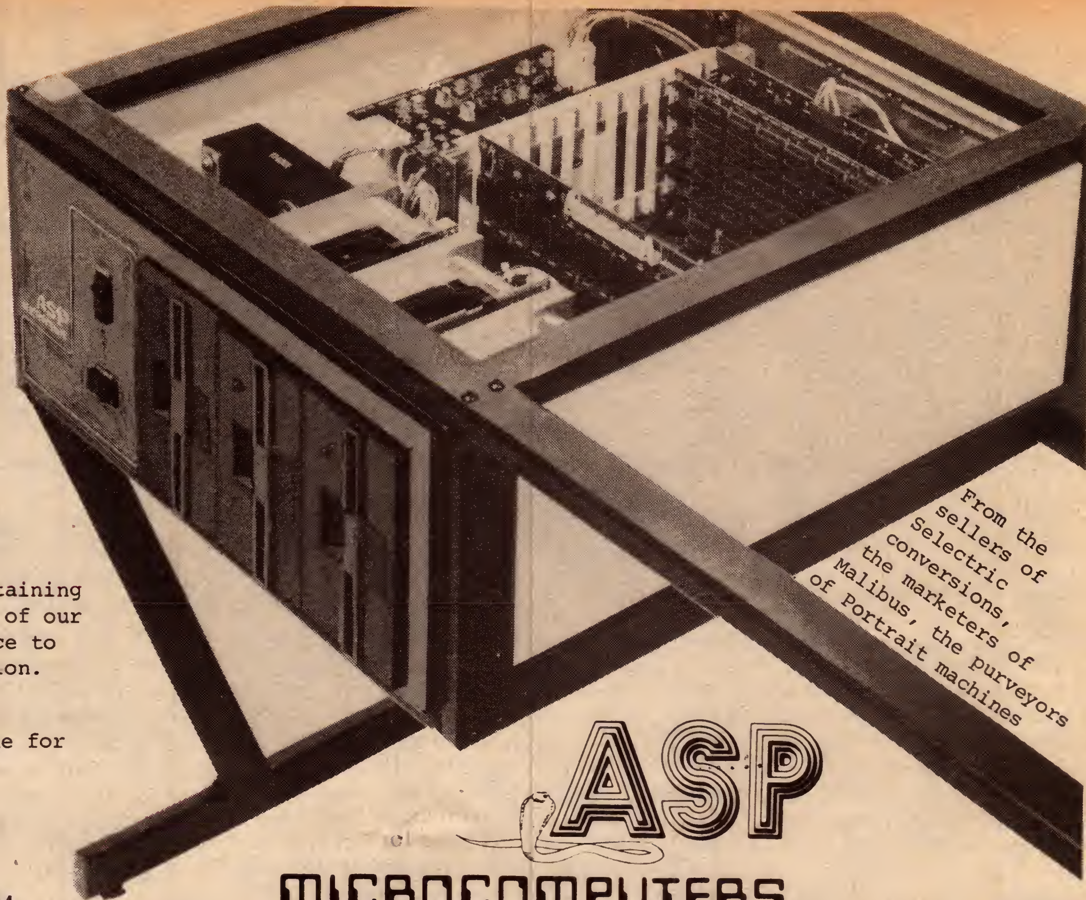
I have an idea he will come back to me if he has any more troubles.

Looking back on the technicalities of the fault there is one point that puzzles me; while it is easy enough to visualise the transistor failing when it became hot, I cannot quite explain why it remained open circuit when it obviously could not have been passing any current.

I can only assume that there was sufficient heat from the red and blue transistors — the green one is in the middle in this set — to maintain this condition once it occurred. They are certainly close together and are fitted with small heat sinks, so this is quite possible.

But I still wish that board was accessible while in the set.

ASPette



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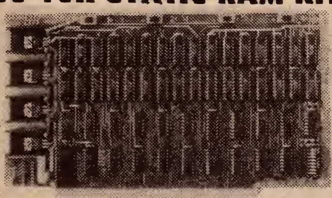

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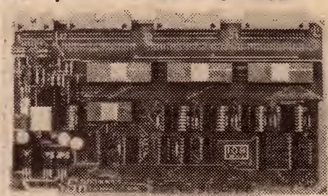

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Southwest's CT-82 "super intelligent" terminal

The new CT-82 intelligent video terminal from Southwest Technical Products provides a bright and crisp 12MHz CRT display, together with an almost bewildering array of software-implemented control functions. Yet it provides these features at a cost lower than many "dumb" terminals.

by JAMIESON ROWE

When you first sit down in front of SWTP's new CT82 terminal, it doesn't seem much different from other terminals. You do notice a few special control keys like "Insert", "Delete" and "Transmit", but apart from that things look fairly familiar.

It's when you open up the CT-82's User Guide Manual that the differences soon start to become apparent. Then it hits you: with the CT-82 you can change virtually all of the operational functions and control parameters involved in such a terminal, and you can change them under software control by merely feeding in a few control characters.

This means that the terminal can be configured any way you wish, either from the keyboard of the terminal itself or from the computer to which it is connected. And it can be reconfigured at any time — on a dynamic basis if required!

What the SWTP people seem to have done is decide that if they were going to produce an "intelligent" microcomputer-based terminal, they would use the microcomputer to provide as much operational and functional flexibility as possible. So as well as provide the ability to edit a slab of text and then send it off as a nicely-prepared block, the CT-82's internal 6802 microcomputer also provides the ability to change all sorts of aspects of the terminal itself.

There are no less than 128 different control function codes recognised by the CT-82. Some of these correspond to standard ASCII control codes, while the majority are made up from two-character combinations.

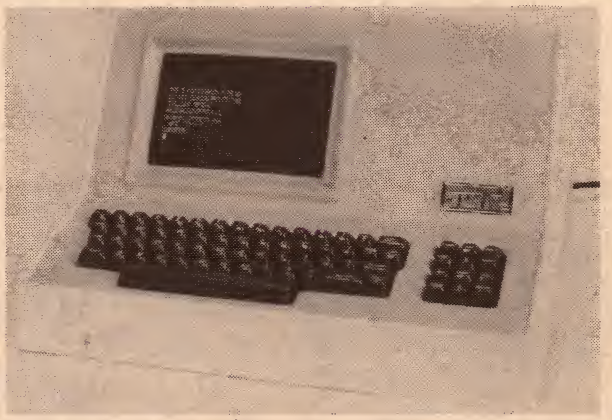
Here are some examples of the terminal configuration flexibility provided. Six control codes are used to configure the CT-82's screen cursor: you can have a block cursor or an underline, blinking or non-blinking, or no visible cursor at all. Eighteen further codes provide for cursor movement control: bump up, down, left or right, move a specified number of positions in the same four directions, home to any of the four display corners, or set either horizontal or vertical position or both.

Six codes are used to configure the CT-82's carriage return/line feed behaviour: you can set it for automatic line feed with carriage return, or not; automatic carriage return/line feed at the end of a line, or not; and automatic scrolling on line feed, or not. A further nine codes are used for configuring interface modes: upper case only, upper and lower, conversational mode or page edit mode, full or half duplex, set baud rate (31 speeds available from 50 to 38,400 baud), and shift mode normal or inverted. Another 22 codes control the CT-82's responses to control characters, and their display or non-display.

For text editing there are eleven different erase functions. Apart from a destructive backspace and line cancel you can erase the whole field, any of the four display quadrants separately, from the cursor to either the end or the start of the field, or from the cursor to the end or the start of the current line. Similarly there are 12 roll and slide functions: apart from scroll up or down, you can roll any of the four quandrants up or down independently, or the whole field to left or right. Eight further codes control insertion and deletion: delete line up or down, insert line up or down, delete character left or right of cursor, and insert character left or right or cursor.

As if functions like these weren't enough, the CT-82 also provides some powerful graphics display features. Some 11 codes are used for these, including the code to select graphics mode. With a display format of 22 lines of 92 six-pixel characters (66x184), the CT-82 lets you clear, set or invert any specified graphics pixel; clear, set or invert a straight line joining any two specified pixel addresses; or move the entire graphics display up, down, to left or to right. Some pretty impressive graphics functions, in other words!

There are a variety of other miscellaneous control codes. The CT-82 can automatically display a binary byte as two hexadecimal digits, if required, or display a two-byte number in left-normalised decimal notation with leading zeroes suppressed. It can also read the current cursor position and feed this back to the computer, or do the same for an optional light pen attachment.



Add all this functional flexibility to a bright, crisp 12MHz CRT display and the reliability provided by state-of-the-art LSI technology, and the CT-82 emerges as a most impressive terminal. Particularly so when you consider that the cost for the basic version is only $950 plus tax — less than the cost of many "dumb" terminals. Even with all options the cost of the CT-82 only rises to around $1250 plus tax, making it outstanding value for money.

Further information on the CT-82 intelligent terminal is available from Southwest Technical Products (Australasia) at 7A Burton Street, Darlinghurst NSW, or PO Box 380, Darlinghurst 2010.

You could build this computer in just a few nights!

DREAM 6800

Second article on this innovative design

This month, author Michael Bauer gives the construction, testing and trouble-shooting procedures for the DREAM 6800. If you get started on yours now, youcould have it ready to run the programs we will be featuring next month. Included inthis article is the full hex listing of the DREAM's high-level interpreter/monitor program, CHIPOS.

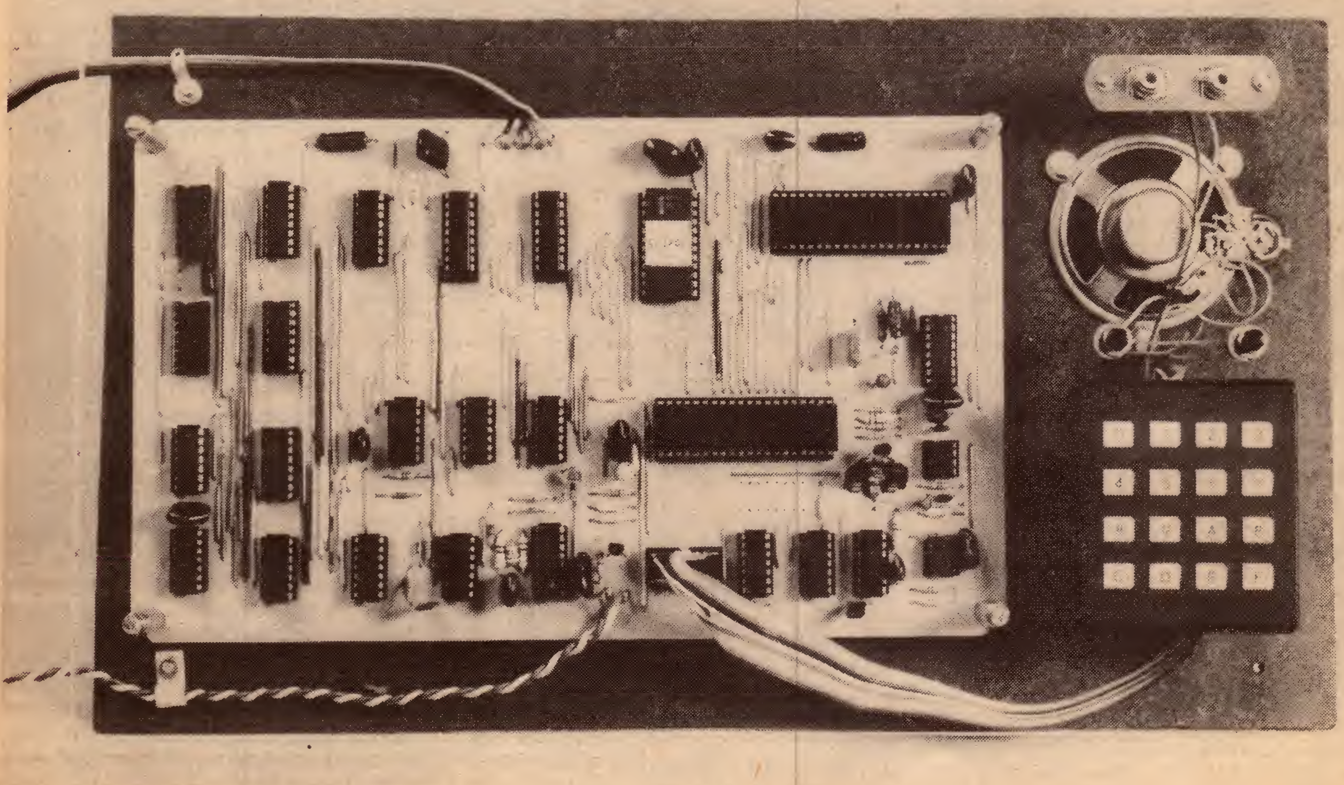
Before soldering, inspect the PCB for flaws. Make sure the PCB is clean. If it is not tin-plated, scrub the copper pattern of the PCB thoroughly with soapy water and steel wool. Solder does not take very well to tarnished or lacquered copper.

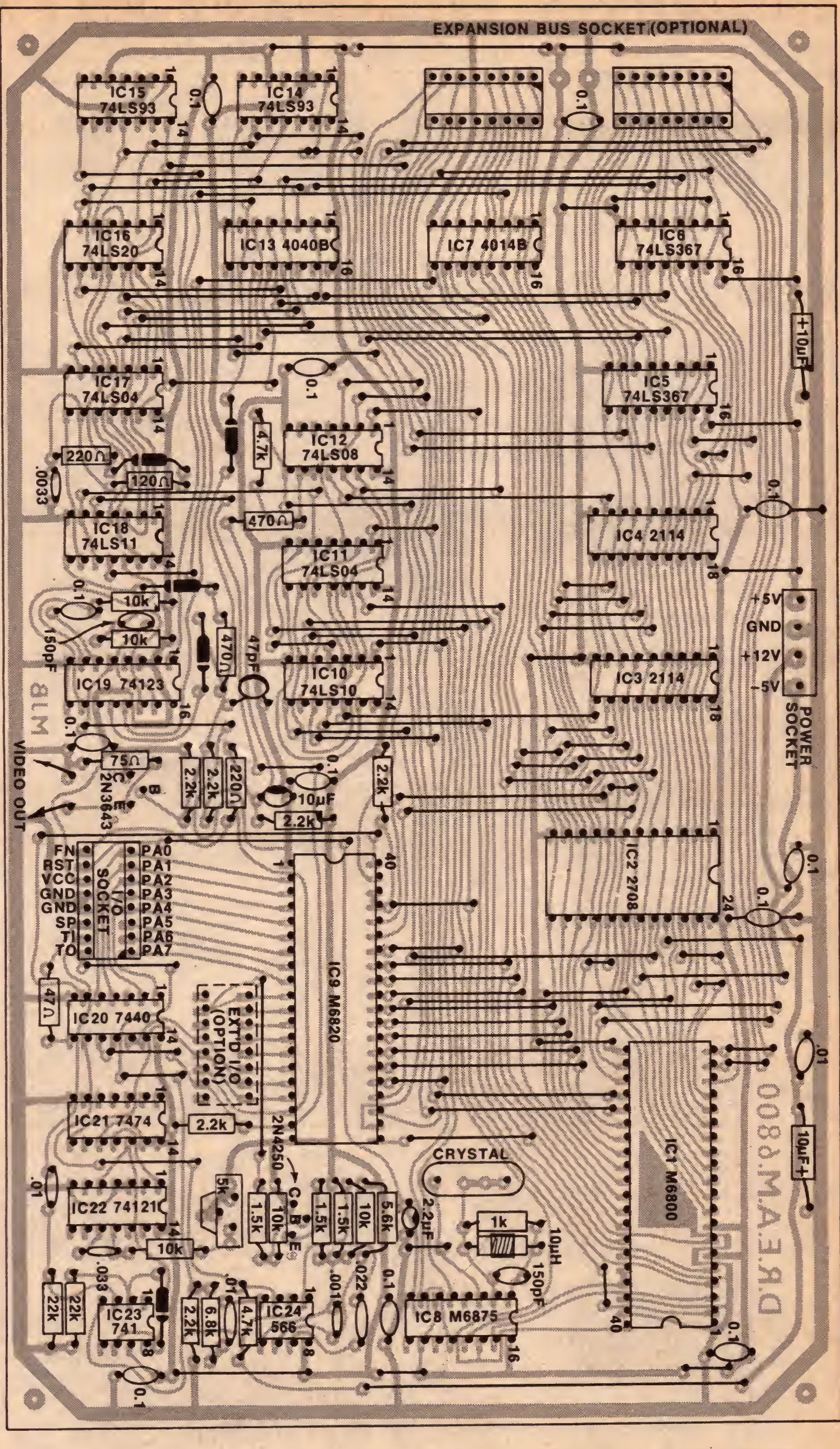
You will need a low wattage (20 to 40W) or temperature controlled soldering iron with a fine tip. Some tracks on the PCB come very close together, which means great care is needed to avoid solder bridging. Use 22 gauge, 60/40 resin-cored solder. Do not attempt the job with an old carbon-element iron like a "Mini-Scope" or "Birko". It's about time you bought a precision soldering instrument, anyway.

(Editor's note: The author's recommendation against carbon-element irons refers to the possibility of damage from these irons to some ICs particularly CMOS types. This is because the heavy current flowing in the soldering iron tip prevents it from being effectively earthed. This allows the possibility of damaging voltages being applied to an IC while it is being soldered.)

Bend the leads of components (and links) with pliers before insertion into the board to avoid stressing the casings. Splay the leads outward on the solder side of the board to hold the part in place during soldering. IC's can be held with masking tape, or a finger if you've got three hands. Note that all resistors (except one) have standard half-inch lead spacing. Use the minimum amount of solder practicable for each joint; don't make blobs!

Our prototype was built on a hardboard base with a perspex cover to protect and show off the PC board.





Install the wire links before mounting any other components on the PCB.

Begin construction with the links, which are considerable in number but think of the $10 or more saved over the price of a double-sided plated-through PCB. Links may be made from tinned copper wire, except for long ones (where there is danger of shorting) which should be insulated. Next, solder in the IC sockets, the keypad I/O socket, and if desired, the expansion sockets. It is recommended to only use sockets for IC's 1,2,3,4,7 and 9. If any others prove faulty, they can be removed with the aid of solder-wick or a solder-vac. The passive components (R,C & L) can then be mounted, followed by the ICs, diodes, pot, transistors, crystal and terminal pins for power and video. Observe orientation of ICs, diodes, tantalum capacitors and transistors. Do not yet plug in ICs 1,2,3 ,4,7 and 9.

Before powering up, inspect your workmanship closely for solder bridges, missing links or components and disoriented parts. By the way, resin residue may be removed from the PCB with a toothbrush dipped in acetone or methylated spirit.

First connect the power supply. Details of a suitable power supply are given elsewhere. You should check the output voltages and regulation under load before applying power to the computer. A 47 ohm, 5 watt resistor will do for a load.

Next, a video monitor needs to be installed. If you can convert your TV to accept a video signal, the results will be worth the effort. Otherwise an RF modulator may be employed to feed the signal into the antenna input. This is the easiest way to get video, and you have the advantage of being able to use your computer on any TV set, anywhere.

Several possibilities exist for choice of keypad. The most economical is to wreck an old calculator. Some obsolete desk-top models used magnetic reed switches which are ideal. The complete computer might be able to be housed in the cabinet of such a calculator. Alternatively, a variety of keyboards, current models and obsolete industry surplus models are available, mainly through the international mail-order houses, at prices from 99 cents to over $10. Whatever you decide on, make sure it is (or can be) wired in a 4 x 4 matrix as shown in the wiring diagram.

Also, it will be an advantage if there is room on or around the keys for labelling (e.g. for special functions, or alphabetic symbols). A further two keyswitches are needed for [FN] and [RST]. As these will be used frequently, they should be of high quality, not cheap and nasty pushbuttons.

Wire the keypad (incl. FN and RST) to a 16-pin DIL plug via a short length (up to 0.5m) of 12-conductor ribbon cable. The GND lines (2) should separate the PA lines from CA2 and RST. Connect a small 8-ohm speaker and diode to pins 11 and 14. The system is now ready for the smoke test.

With ICs 1, 2, 3, 4, 7 and 9 removed, power and TV connected, switch on and immediately check voltages at the power socket. If there are no loud noises nor signs of molten silicon, adjust your TV (and RF modulator) to get a large white rectangle centred on the screen. If it is not forthcoming, chances are that there's something wrong with your RF modulator, or a certain 2N3643 is in backwards. Having eliminated these as the source of error, but still getting no picture, go to the section on trouble-shooting.

One you've got a picture (large white rectangle), remove power and proceed to plug in ICs 1,2, 3, 4, 7 and 9, and the keypad and speaker. It is very important when handling MOS devices that everything is at the same potential and preferably earthed, in particular your

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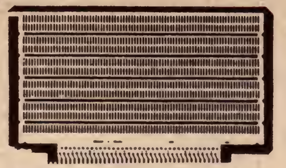

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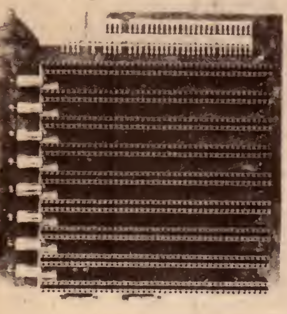

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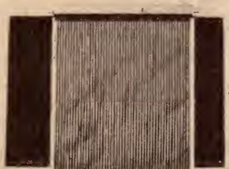

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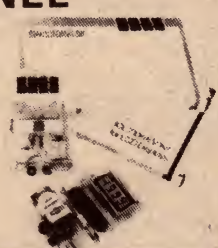

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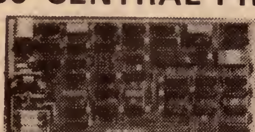

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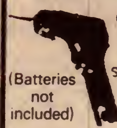

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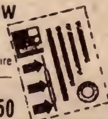

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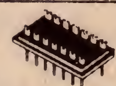

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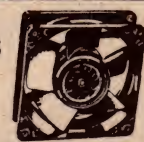

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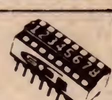

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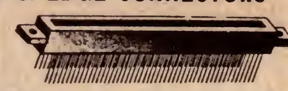
22 PIN	1-20		

P.C. EDGE CONNECTORS



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10 TURN POTENTIOMETERS
Stock resistance values

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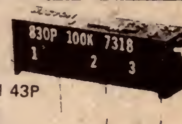
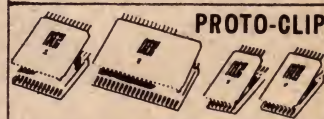
Spectrol model 534 ¼" shaft
Price 1—9 .... **$6.75**
10 + values may be mixed **$5.75**

CERMET 20 TURN TRIM POT



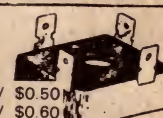
Spectrol Model 43P
ACTUAL SIZE
STOCK VALUES
10, 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K, 50K, 100K, 200K, 500K, 1M, 2M .... 1—9 **$1.10**
Values may be mixed. 10+ **$0.98**

PROTO-CLIP



For power-on/hands off signal tracing. Bring IC leads up from PC board surface for last troubleshooting.
PC14 4.50 PC24 8.50
PC16 4.75 PC40 13.75

BRIDGE RECTIFIERS



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printed board (GND line), your work surface, and yourself. Don't wear nylon pantyhose or rub ebonite rods in your hair while handling MOS!

Apply power once again, and you should notice a short bleep in the speaker and something resembling fig. 2 on the screen. The actual pattern and 4-digit number seen are just random garbage in the RAM at switch-on. Try keying in any 4 hex digits. This number should then appear on the screen, and if so, your computer is, in all probability, fully operational. See how many 4-letter words you can make from the hex digits: A,B,C,D,E and F. If your system fails to display the above information (after resetting), see how many 4-letter words you can mutter to yourself and then proceed calmly to the section on trouble-shooting.

Once the video generator and processor appear to be working, you can try using the memory-modify command. Hit [RST], then enter 0, 1, 0, 0, the starting address of the display refresh buffer. Now key [FN] followed by [0] to get into "memod". The display window will show a 2-digit number beside the address. This is the contents of location 0100, which can also be seen in binary at the upper LHS of the screen. (A white dot = 1, no dot = 0.) Step through the memory by pressing [FN] repeatedly. Go back to 0100 (hit [RST], 0, 1, 0, 0, [FN], 0). This time, write into the buffer by keying in a pair of hex digits, and another, and another . . . noting the binary pattern formed by each byte.

Notice that as data bytes are deposited into memory, the address flips to the next address, before you see the byte just keyed in. This is a design compromise (not an oversight), but should be of no concern because you're not likely to be looking at the screen anyway, when keying in a program. One eye will be on a listing, the other on the keypad. The data, having been entered, can be verified later by stepping through with the [FN] key.

Getting the feel for it, and want to try a CHIP-8 program? Try the simplest possible! Use memod to enter this data at 0200:

Address	Data	Mnemonic
0200	F0	go to monitor
0201	00	

The instruction F000 does not exist, and will result in a jump back to the monitor (CHIPOS), but first the interpreter clears the screen, as it does at the start of each new program, (unless you start from C002). To run this "program", hit RST, C000, FN, 3 (GO from C000).

Here's something to watch CHIPOS's random number generator at work:

0200	CA3F	VA is random x-coord (00-63)
0202	CB1F	VB is random y-coord (00-31)
0204	A20A	Point to pattern byte (I=20A)
0206	DAB1	Display 1 byte at coords (VA, VB)
0208	1200	Go to loc'n 0200 for next instr'n
020A	8000	DATA: 80hex = 10000000 binary = dot.

Before the programs get too much bigger, you'll want to save them on cassette. If your recorder has line (auxiliary) input and output, you're fortunate because these voltage levels are optimum for use with the DREAM-6800's tape modem. Also it is highly desirable (but not essential) that the recorder's internal speaker not be muted, so that the leader tone can be located by sound. Hence, recorders with only an EXT-SPKR (or earphone) jack should be modified such that insertion of the plug does not result in disconnection of the speaker. If this is awkward, another speaker can always be connected externally.

Do not operate the recorder at high volume when connected to the computer. Voltage levels exceeding 5V peak-peak could damage IC23, but this is improbable at normal listening levels. Further, recorders without an AUX input may require a much lower signal level from the computer, for use with the "MIC" input. This problem is easily solved by inserting a 220k resistor in series with the "TAPE-OUT" line (pin-16). Shielded cable should be used for the tape connections, with the shield wired to pin-13 of the I/O plug.

To test the cassette functions, proceed as follows. Use the "memod" function to create a pattern on the screen, as described earlier. Then define the beginning and ending addresses of the block you want to save, in this case the display buffer page from 0100 to 01FF. For convenience, the ending location PLUS ONE is specified. Hence to dump the display, deposit the following data at 0002:

0002	01	Beginning address MSB
0003	00	Beginning address LSB
0004	02	Ending address (+1) MSB
0005	00	Ending address LSB

HOW WE BUILT OURS:

Since the author did not present a proto-type with his article, we decided to build our own, both to confirm the design and to aid presentation of this attractive system in the magazine. With the latter idea paramount, we decided to mount the PCB on a hardboard base with a perspex cover to protect and show off the unit.

The perspex cover is also used to mount the keyboard, two pushbuttons and the tape interface sockets. This method of construction is easy to build, is very economical and produces an attractive unit.

Readers will note that we have used IC sockets for the ICs on the PCB. We did this as a precaution — if bugs had shown up, we wanted to be able to change ICs with a minimum of work. Nevertheless we are inclined to agree with the author's comments on IC sockets.

The miniature speaker is mounted face down on the hardboard base. Even so we found the loud bleeps it emitted quite annoying, so we muted it with a preset pot, as suggested by the author.

Rather than salvage a keyboard from a calculator or other source, we took the easy but expensive approach of buying a new one. We used a Digitran KL0043 keyboard, which has the buttons connected in a 4 x 4 matrix as required but with a slightly different numbering to that shown on the circuit published last month. However, this presents no problem.

The keyboard can be purchased from Radio Despatch Service, 869 George Street, Sydney, NSW 2000. Radio Despatch Service have notified us that since the wholesale price of the keyboard is high, they have reduced their own margin to a minimum. Even so, the KL0043 will set you back by $20.43, including sales tax. Radio Despatch Service also have a ready source of suitable perspex in the form of surplus smoke-tinted record deck covers, at $2 each.

For the RST and FN pushbuttons we used two good quality momentary contact switches. We didn't bother to label these as they are used so often that it soon becomes second-nature. The FN button is mounted on the right and the RST on the left, immediately above the keyboard.

The major ICs for our unit, with the exception of the CHIPOS EPROM, were supplied by Total Electronics, 155 Willoughby Road, Crows Nest, NSW 2065. Silicon Valley Stores and Applied Technology Pty Ltd, 1a Pattison Avenue, Waitara, NSW 2077 will be able to supply all the IC's, including the CHIPOS (2708) EPROM.

Two other firms have EPROM programming services: A.J.F. Systems & Components Pty Ltd, 29 Devlin Sreet, Ryde, NSW 2112 and Warburton Franki (Sydney) Pty Ltd, 199 Parramatta Road, Auburn, NSW 2144.

DREAM 6800

[N.B.: 01FF+1=0200; MSB = Most significant (high-order) byte; LSB = Least significant (low-order) byte.]

Thus, a 256-byte block is defined, from 0100 to 0200, not including the last byte (at 0200). The same block applies to a load or dump. This simple tape format lets you load a file (or part thereof) into any place in RAM, regardless of where it was dumped from, thereby allowing relocation of data or programs.

Having got that, reset the system, start the cassette in RECORD mode and adjust the recording level, and let it run for several seconds to write a "leader" tone (steady 2400 Hz). Then key [FN][2] (dump/save). The screen will be disabled until the dump is complete, because the serial I/O software cannot tolerate the display refresh delays.

To verify the dump, and to test your demodulator, power down the system to destroy RAM contents. Once again, enter the begin and end locations, as above. Set the DEMOD trimpot to mid-position. Rewind and play the tape until the leader tone is heard, then press [FN][1] (load). The display will again black out and should return at the instant the last byte is accepted, hopefully revealing your saved pattern.

If anything goes wrong, first retry the above steps. Then try various recording and playback levels, or try adjusting the DEMOD trimpot (although this should be non-critical in the majority of cases). As a last resort, you might have to check the modem with a CRO, but be suspicious of external troubles first. Also note that it pays to use good quality cassettes.

That concludes the testing procedure. Now you can look forward to entering and saving much larger programs. Be sure to write down the block loading addresses on the cassette index. It's a good idea to always use "standard" size blocks; e.g. 0200-0300 for a small program; 0200-0400 for a medium; and 0080-0400 to dump all usable RAM. Refrain from dumping/loading 0000-0080, because this area is reserved for CHIPOS's scratchpad and stacks.

Just a final note for perfectionists. The width of the first and last dot (on every row) is controlled by the delay network on H64, (120 ohms, 220R, 220 ohms, .0033uF). If the RHS dots are too narrow, first try increasing C to .0047uF. Also, the frequency of the cassette modulator (2400Hz, marking) can be adjusted by the 5.6k resistor. Speaker volume can be reduced with a series resistor or 500 ohm trimpot.

```
C000  8D 77 CE 02 00 DF 22 CE 00 5F DF 24 DE 22 EE 00
C010  DF 28 DF 14 BD C0 D0 96 14 84 0F 97 14 8D 21 97
C020  2E DF 2A 96 29 44 44 44 44 8D 15 97 2F CE C0 48
C030  96 28 84 F0 08 08 80 10 24 FA EE 00 AD 00 20 CC
C040  CE 00 2F 08 4A 2A FC A6 00 39 C0 6A C0 A2 C0 AC
C050  C0 BA C0 C1 C0 C8 C0 EE C0 F2 C0 FE C0 CC C0 A7
C060  C0 97 C0 F8 C2 1F C0 D7 C1 5F D6 28 26 25 96 29
C070  81 E0 27 05 81 EE 27 0E 39 4F CE 01 00 A7 00 08
C080  8C 02 00 26 F8 39 30 9E 24 32 97 22 32 97 23 9F
C090  24 35 39 DE 14 6E 00 96 30 5F 9B 15 97 15 D9 14
C0A0  D7 14 DE 14 DF 22 39 DE 14 DF 26 39 30 9E 24 96
C0B0  23 36 96 22 36 9F 24 35 20 E8 96 29 91 2E 27 10
C0C0  39 96 29 91 2E 26 09 39 96 2F 20 F0 96 2F 20 F3
C0D0  DE 22 08 08 DF 22 39 BD C2 97 7D 00 18 27 07 C6
C0E0  A1 D1 29 27 EB 39 C6 9E D1 29 27 D0 20 D5 96 29
C0F0  20 3B 96 29 9B 2E 20 35 8D 38 94 29 20 2F 96 2E

C100  D6 29 C4 0F 26 02 96 2F 5A 26 02 9A 2F 5A 26 02
C110  94 2F 5A 5A 26 0A 7F 00 3F 9B 2F 24 03 7C 00 3F
C120  5A 26 0A 7F 00 3F 90 2F 25 03 7C 00 3F DE 2A A7
C130  00 39 86 C0 97 2C 7C 00 2D DE 2C 96 0D AB 00 A8
C140  FF 97 0D 39 07 C1 79 0A C1 7D 15 C1 82 18 C1 85
C150  1E C1 89 29 C1 93 33 C1 DE 55 C1 FA 65 C2 04 CE
C160  C1 44 C6 09 A6 00 91 29 27 09 08 08 08 5A 26 F4
C170  7E C3 60 EE 01 96 2E 6E 00 96 20 20 B0 BD C2 C4
C180  20 AB 97 20 39 16 7E C2 E1 5F 9B 27 97 27 D9 26
C190  D7 26 39 CE C1 BC 84 0F 08 08 4A 2A FB EE 00 DF
C1A0  1E CE 00 08 DF 26 C6 05 96 1E 84 E0 A7 04 09 86
C1B0  03 79 00 1F 79 00 1E 4A 26 F7 5A 26 EB 39 F6 DF
C1C0  49 25 F3 9F E7 9F 3E D9 E7 CF F7 CF 24 9F F7 DF
C1D0  E7 DF B7 DF D7 DD F2 4F D6 DD F3 CF 93 4F DE 26
C1E0  C6 64 8D 06 C6 0A 8D 02 C6 01 D7 0E 5F 91 0E 25
C1F0  05 5C 90 0E 20 F7 E7 00 08 39 0F 9F 12 8E 00 2F

C200  DE 26 20 09 0F 9F 12 9E 26 34 CE 00 30 D6 2B C4
C210  0F 32 A7 00 08 7C 00 27 5A 2A F6 9E 12 0E 39 D6
C220  29 7F 00 3F DE 26 86 01 97 1C C4 0F 26 02 C6 10
C230  37 DF 14 A6 00 97 1E 7F 00 1F D6 2E C4 07 27 09
C240  74 00 1E 76 00 1F 5A 26 F5 D6 2E 8D 28 96 1E 8D
C250  15 D6 2E CB 08 8D 1E 96 1F 8D 0B 7C 00 2F DE 14
C260  08 33 5A 26 CB 39 16 E8 00 AA 00 E7 00 11 27 04
C270  86 01 97 3F 39 96 2F 84 1F 48 48 48 C4 3F 54 54
C280  54 1B 97 1D DE 1C 39 C6 F0 CE 80 10 6F 01 E7 00
C290  C6 06 E7 01 6F 00 39 8D EE 7F 00 18 8D 55 E6 00
C2A0  8D 15 97 17 C6 0F 8D E1 E6 00 54 54 54 54 8D 07
C2B0  48 48 9B 17 97 17 39 C1 0F 26 02 D7 18 86 FF 4C
C2C0  54 25 FC 39 DF 12 8D BF A6 01 2B 07 48 2A F9 6D
C2D0  00 20 07 8D C2 7D 00 18 26 EC 8D 03 DE 12 39 C6
C2E0  04 D7 21 C6 41 F7 80 12 7D 00 21 26 FB C6 01 F7
C2F0  80 12 39 8D 00 37 C6 C8 5A 01 26 FC 33 39 CE 80

C300  12 C6 3B E7 01 C6 7F E7 00 A7 01 C6 01 E7 00 39
C310  8D 13 A6 00 2B FC 8D DD C6 09 0D 69 00 46 8D D3
C320  5A 26 F7 20 17 DF 12 CE 80 12 39 8D F8 36 6A 00
C330  C6 0A 8D BF A7 00 0D 46 5A 26 F7 32 DE 12 39 20
C340  83 86 37 8D B9 DE 02 39 8D F7 A6 00 8D DD 08 9C
C350  04 26 F7 20 0B 8D EA 8D B7 A7 00 08 9C 04 26 F7
C360  8E 00 7F CE C3 E9 DF 00 86 3F 8D 92 8D 43 0E 8D
C370  CE 4D 2A 10 8D C9 84 03 27 23 4A 27 D8 4A 27 C8
C380  DE 06 6E 00 8D 0C 97 06 8D 06 97 07 8D 23 20 DF
C390  8D AD 48 48 48 48 97 0F 8D A5 9B 0F 39 8D 12 DE
C3A0  06 8D 25 8D 9A 4D 2B 04 8D E8 A7 00 08 DF 06 20
C3B0  EC 86 10 8D 2B CE 01 C8 86 FF BD C0 7D CE 00 06
C3C0  8D 06 08 8D 03 8D 15 39 A6 00 36 44 44 44 44 8D
C3D0  01 32 DF 12 BD C1 93 C6 05 BD C2 24 86 04 9B 2E
C3E0  97 2E 86 1A 97 2F DE 12 39 7A 00 20 7A 00 21 7D
C3F0  80 12 3B DE 00 6E 00 00 C3 F3 00 80 00 83 C3 60
```

This is the complete listing for the CHIPOS interpreter/monitor program.

TROUBLE-SHOOTING

In the unlikely event that your computer malfunctions, the cause must be either a constructional error or a faulty component. Therefore, proceed to double check the board. Inspect the solder side with a magnifying glass and if any tracks appear to be touching, scrape between them with a sharp pointed instrument. Remember to ground yourself and the board. Look for disoriented components, and incorrect values. Check that all links are present. From here on, it is assumed that the wiring is correct and that your power supply and video monitor are working properly.

The first step is to get the video display generator up. ICs 1, 2, 3, 4, 7 and 9 should be removed at this stage. First check the clock (IC8). There should be 1MHz square waves at pins 7, 13, and 15, and 2MHz at pin 5 (to VDG). Also check RST (pin 14) is high. If trouble, check that the crystal is oscillating (1MHz sine-wave at pin 2), using a x10 probe on your CRO. If not, try it without the L-C tank circuit (150pF/10uH). If no success, you have a bad crystal, or 6875.

If there appears to be some video output, but you can't get the picture to lock, the trouble is probably in your RF modulator. Try reducing the level of the video input signal to the modulator. Also, beware of harmonics; perhaps you have been trying to tune in to a spurious signal eminating from the thing.

Assuming the presence of a 2MHz clock signal, check for horizontal and vertical sync pulses (4us every 64us, and approx. 300us every 20ms, resp.). If no sync, check counter outputs (ICs 15, 14, 13, in that order). Vertical problems could also be caused by IC 13 not resetting or by a faulty one-shot (IC19b). There's not much else that can go wrong with the VDG itself, except when interacting with the MPU.

Having obtained a rock solid white rectangle display, the next step is to check operation with the processor. With all ICs installed, switch on (and reset) the system again. Press a few hex keys. Are the keystrokes being acknowledged with a bleep, but something incoherent is being displayed? If so, do the following, in order given:—

1. Check the LOAD pulse (IC7, pin 9); should be 500 to 800 nanosec, every 8 dot-clock cycles (4us).
2. Remove ICs 1, 2 and 9 (MPU, ROM, PIA); connect BA (IC11, pin 13) to +5V; proceed to check the DMA address bus (outputs of buffers, IC5, 6). The signals should be the same as the respective inputs. Now remove the +5V connection to BA. The outputs should no longer follow the inputs, but "float". If any of the Tristate buffers appear to be faulty, replace it.
3. Re-insert all ICs previously removed. The screen should show RAM contents, usually some kind of vaguely ordered pattern, or random dots. Try grounding WE (IC3, pin 10) momentarily with a jumper lead, a few times, while the system is running. The display should change each time. If not, suspect the 4014 (IC7).
4. Finally, the least likely cause of the above symtoms is a bad EPROM.

At this stage, we are assuming that the video is behaving itself, but a processor malfunction is suspected. With all chips on board, press the [RST] key. The speaker should bleep when the key is held down (even if the PIA is at fault), and the RST line (IC8, pin 14) should go LOW momentarily. If not, check the 2.2uF tantalum capacitor and RST wiring. Note that the Reset function is performed by the 6875. If the system does not appear to be resetting, you could have a faulty EPROM, RAM, MPU or PIA!

(Continued on p125)

PARTS LIST

HARDWARE
1 PC board, 244 x 142mm
1 4.000MHz crystal
1 hexadecimal keypad (4 x 4 matrix)
2 momentary-contact pushbuttons
2 RCA phono sockets
1 small loudspeaker
1 10uH inductor

SEMICONDUCTORS
1 6800 microprocessor
1 6821 peripheral interface adaptor
1 6875 clock generator
1 2708 EPROM (programmed with CHIPOS)
2 2114 static RAMs
1 4040B CMOS counter/divider
1 4014B CMOS static shift register
2 74LS04 hex inverter
1 74LS08 quad 2-input gate
1 74LS10 triple 3-input gate
1 74LS11 triple 3-input gate
1 74LS20 dual 4-input gate
1 7440 dual 4-input buffer
1 7474, 74LS74 dual D flipflop
2 7493, 74LS93 binary counter
1 74121 one-shot multivibrator
1 74123 dual one-shot
2 74LS367 Tristate buffer
1 566 function generator
1 741 operational amplifier
1 2N3643 NPN transistor
1 2N4250 PNP transistor
6 1N4148 silicon diodes

IC Sockets
2 40 pin
1 24 pin
2 18 pin
3 16 pin
1 16 pin DIL plug

CAPACITORS
2 10uF/16VW aluminium electrolytic
1 10uF/16VW tantalum electrolytic
1 2.2uF tantalum electrolytic
12 0.1uF polyester or ceramic
1 .033uF polyester
1 .022uF polyester
2 .01uF polyester
1 .0033uF polyester
1 .001uF polyester
2 150pF ceramic
1 47pF ceramic or polystyrene

RESISTORS
(¼W, 10% tolerance)
2 x 22k, 5 x 10k, 1 x 6.8k, 1 x 5.6k, 2 x 4.7k, 5 x 2.2k, 3 x 1.5k, 1 x 1k, 2 x 470 ohms, 2 x 120 ohms, 1 x 75 ohms (or 2 x 150 ohms), 1 x 74 ohms.
1 5k trimpot (vertical mounting)

MISCELLANEOUS
Ribbon cable, tipped copper wire, spaghetti sleeving, shielded cable, PC pins, 22g solder, 3 extra DIL plugs and sockets (if required for expansions).

A Power Supply for the DREAM 6800 computer

This power supply was designed specifically to meet the power requirements of the DREAM6800 computer published elsewhere in this issue. The supply provides three rails: ±5V and +12V, each with more than adequate current capability.

by LEO SIMPSON

As part of our presentation of the highly innovative DREAM 6800 computer we decided to produce a suitable power supply. You could call it the "DREAM POWER". The circuit is much the same one originally roughed out by designer Michael Bauer, but we have produced a PC board for it, to make construction easy. After all, why make the computer easy to build but the power supply difficult?

Maximum power requirements (worst case) of the DREAM 6800 are +5V at 1 amp, -5V at 100 milliamps and +12V at 100 milliamps. This is easily and simply provided by a bridge rectifier and transformer with a centre-tapped 30V secondary winding.

The bridge rectifier feeds a 2200uF/25VW filter capacitor for the two positive supply rails and a 1000uF/25VW capacitor for the lightly loaded -5V rail. Under normal load conditions, both capacitors will be charged to 20VDC or more. This is necessary for good line regulation of the 12V rail, but means that the voltage drop and thus power dissipation of the two 5V regulators is higher than ideal.

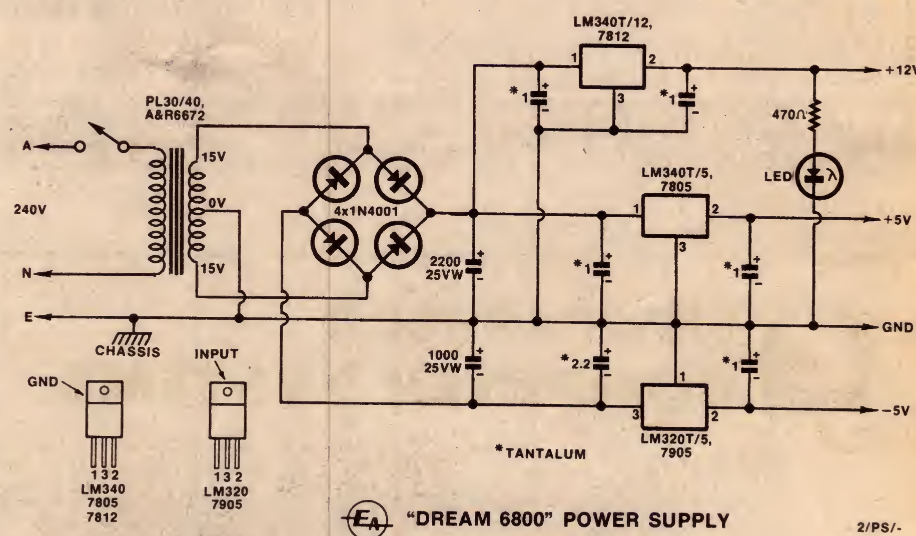
Fortunately, the -5V regulator is lightly loaded, as noted before, and therefore does not dissipate much power. But the +5V regulator dissipates 10 watts or more, which requires an effective heatsink. We settled on this perhaps wasteful compromise because it results in a simple rectifier circuit and uses an economical and readily available transformer.

Power dissipation in the regulators could perhaps be reduced by substituting a transformer with a centre-tapped 24V secondary. This would result in approximately 17VDC across the filter capacitors instead of more than 20VDC. However, this approach might prejudice the line regulation of the 12V regulator in areas where the mains voltage is prone to drop below 240VAC.

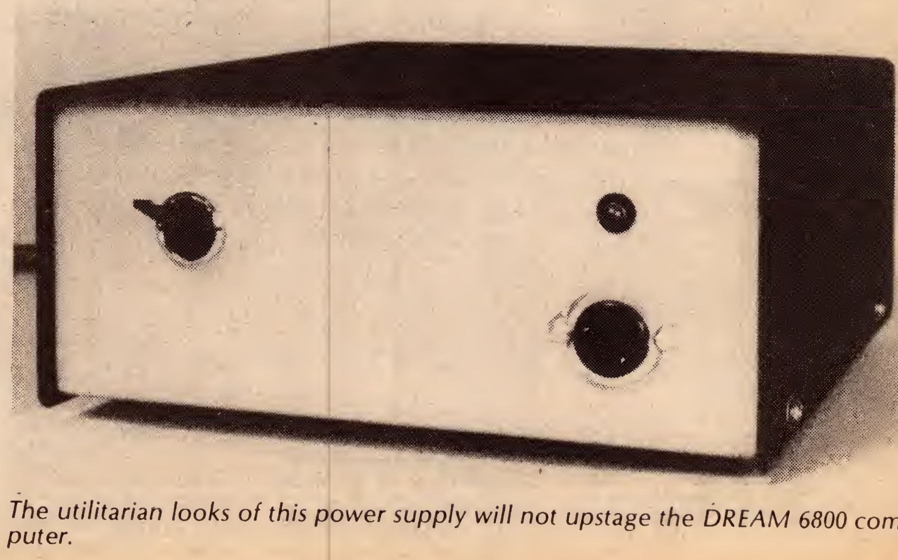
While only the +5V regulator is required to supply 1 amp, we have standardised on 1 amp regulators for all three since they are the most readily available. If you are able to obtain 12V and negative 5V regulators of lower rating at a good price, then by all means use those instead.

All the circuitry for the power supply is accommodated on a small PC board measuring 81 x 90mm and coded 79ups6. The bridge rectifier consists of four 1 amp diodes such as 1N4001 or similar types. Even though the two filter capacitors are reasonably close to the regulators in terms of conductor length, we have taken the usual precautions to ensure stability of the regulator ICs.

These precautions take the form of 1uF tantalum capacitors at the input and output of each regulator. An exception to this is the negative 5V regulator, which requires a 2.2uF tantalum capacitor at its input. In general, the input capacitors are required to prevent high frequency oscillation of the main emitter-follower in the regulator IC, while the output capacitor ensures a low output impedance at



This circuit has adequate current ratings for the requirements of the DREAM 6800.



The utilitarian looks of this power supply will not upstage the DREAM 6800 computer.

high frequencies.

We used a standard case from Dick Smith Electronics to house the power supply. This has a sturdy steel wrapover cover with ventilation holes, but the U-shaped pan section is made of light-gauge aluminium which is quite flimsy. In addition, it is painted so it is quite inadequate as a heatsink for the +5V regulator. Overall dimensions of the case are 160 x 70 x 184mm (W x H x D).

PARTS LIST

HARDWARE
1 case with lid, 160 x 70 x 184mm
1 PC board, 81 x 90mm, code 79ups6
1 transformer with 30V centre-tapped secondary at 1 amp DC or more; Ferguson PL30/40VA, A&R 6672, DSE M-6672 or similar
1 SPST mains toggle switch
1 3-way insulated terminal block
1 single-sided heatsink, 100 x 50mm, or larger
8 PC pins
4 Richo PCB supports
1 solder lug
1 4-pin polarised plug and socket
1 Mains cord and plug (preferably one-piece moulded type)
1 mains cord clamp

SEMICONDUCTORS
4 1N4001 silicon diodes
1 LM340T-5.0, regulator uA7805 regulator
1 LM340T-12, uA7812 regulator
1 LM320T-5.0, uA7905 regulator
1 LED and bezel holder

PASSIVE COMPONENTS
1 x 2200uF or 2500uF/25VW pigtail electrolytic
1 x 1000uF/25VW pigtail electrolytic
1 x 2.2uF tantalum electrolytic
5 x 1uF tantalum electrolytic
1 470 ohm ¼ or ½W resistor

MISCELLANEOUS
Heatshrink tubing, hook-up wire, screws, nuts, lockwashers, solder.

NOTE: See text for possible component substitutions.

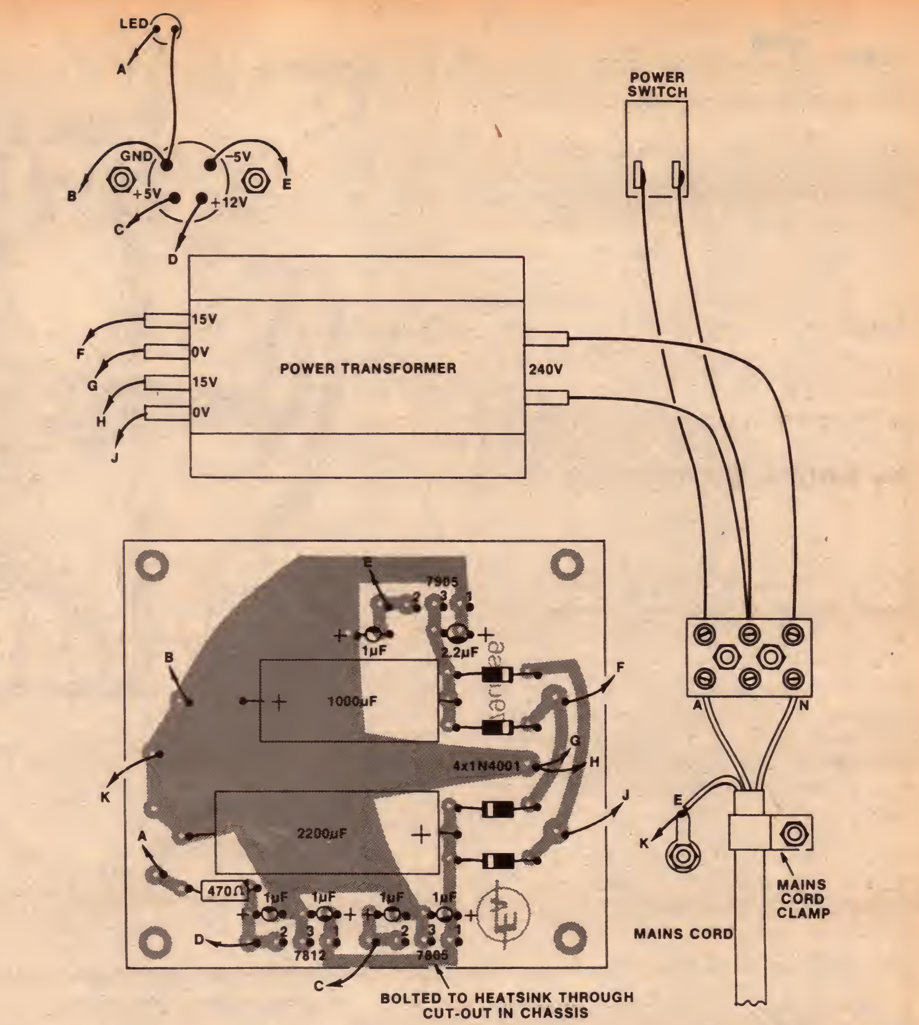
To solve the heatsink problem we cut a small window (about 20 x 25mm) in the rear of the case, coinciding with the position of the +5V regulator. This enabled this regulator IC to be bolted directly to a single-sided extruded aluminium heatsink of reasonable size. We did not fit heatsinks to the other regulators.

Note that the lead arrangement on the negative 5V regulator differs from positive regulators: the centre lead and metal flag are connected to the input rather than GND (OV).

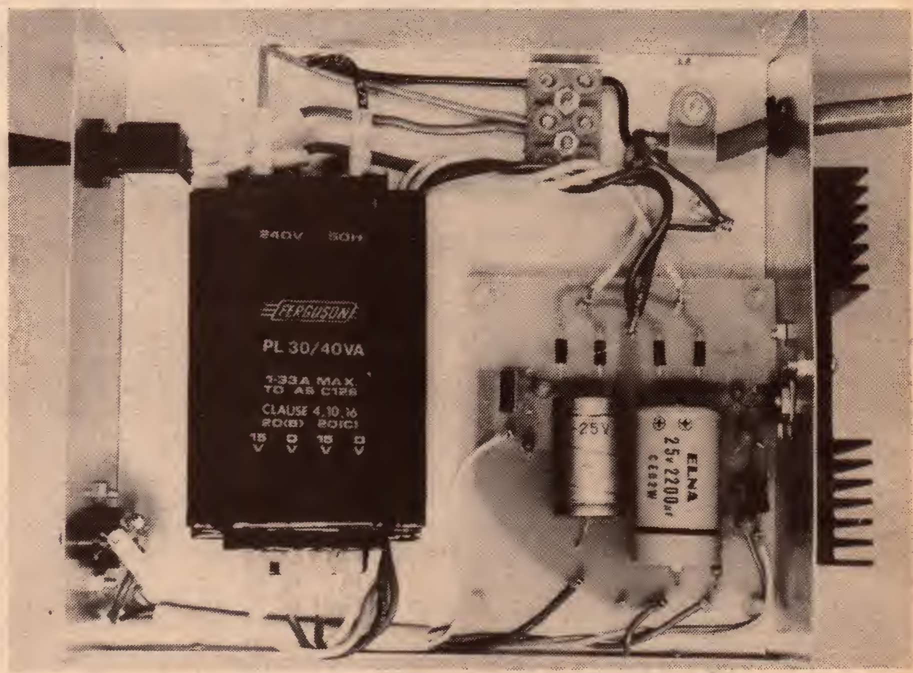
Use PC pins on the PC board, to simplify connections. 8 pins are required.

Several readily available power transformers can be used. We used the Ferguson PL30/40VA. Others which would fill the bill are the A&R 6672 or the Dick Smith equivalent, M-6672.

Take care with the mains wiring. The three core mains cord should be passed through a grommetted hole in the rear



Follow this diagram and the photograph below for easy assembly of the power supply.



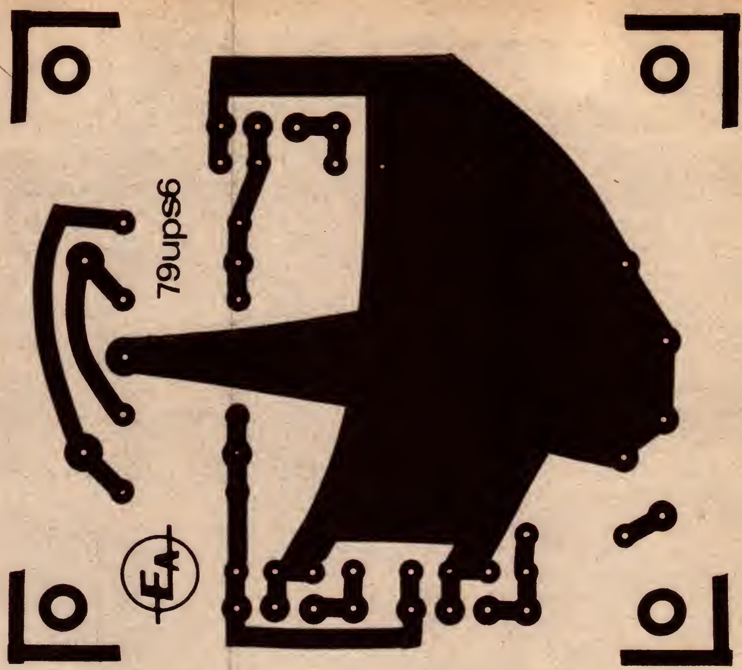
of the case and anchored with a cord clamp. Mechanically terminate and solder the earth wire to a solder lug screwed to the case. Terminate the active and neutral conductors plus the wires to the transformer primary and the mains toggle switch via a three-way insulated terminal block.

> We estimate that the current cost of parts for this power supply is approximately
>
> **$38**
>
> This includes sales tax.

Make sure that the soldered connections to the mains switch and the transformer primary are insulated with heatshrink tubing or similar material. In the case of the Ferguson transformer, this problem is taken care of by sheathed push-on connections.

We terminated the regulator outputs in a 4-pin polarised socket which is convenient for cable connection. However there is no reason why separate screw terminals or jack sockets could not be used.

Before the power supply is put into service it is a good idea to check the output voltages. Use a 47 ohm 1W resistor to load the 5V regulators and a 100 ohm resistor of 2W rating or more for the 12V regulator. For the 5V regulators the acceptable range of output voltage is 4.75 to 5.25V, while for the 12V regulator the range is 11.4 to 12.6V.



Actual size artwork for the PC board.

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1000uF	63V	2.90	4700uF	100V	$9.50
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1000uF	160V	$6.50			PCB
2500uF	35V	$2.90	6800uF	50V	$4.80
2500uF	63V	$2.60	8000uF	75V	$7.90

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40+40	350V	$2.75	150+100		
50+50	350V	$3.50	+100	315V	$9.90
40+80	300V	$4.30	200+60	275V	$4.90
			200+100	350V	$7.90

COMPUTER GRADE ELECTROS

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6800uF	16V	$5.75	22,000uF	25V	$12.00
10,000uF	16V	$8.00	22,000uF	40V	$20.50
10,000uF	26V	$9.00	27,000uF	35V	$21.70
10,000uF	40V	$11.50	68,000uF	16V	$19.50

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Psst! Want the most complex clock in town?

LED display for your 2650

Interfacing your 2650 Mini Computer to a set of common-cathode LED displays requires only a single IC and a handful of other parts. With such an interface you can have your 2650 perform many number display tasks — including display of the time!

by DAVID EDWARDS* *69 Anglo Road, Campsie, NSW 2194

There are many applications where a processor is required to drive a simple numerical display, and this can be achieved in a variety of ways. It is possible to have either a multiplexed or non-multiplexed display, for instance, and one can decode from binary or BCD to seven-segment display format with either hardware or software. The circuit presented here uses hardware for the BCD to seven-segment decoding function, but has the multiplexing of the digits under software control.

A single 4511 CMOS IC is used to convert incoming BCD numbers to seven-segment format, and is connected to bits 0 to 3 inclusive of the "D" non-extended output port on the 2650 system. Refer to the November 1978 issue for details of how to implement the I/O ports available with the 2650 CPU. Four 470k resistors are used to pull the inputs low, so that the decoder is present to the "O" state if no input signals are connected.

The lamp test (LT) and blanking input (BI) pins are tied permanently high, while the latch enable (LE) pin is tied low. +5V is supplied to the 4511 from the 2650 Mini Computer, and bypassing is provided by a 100uF electrolytic capacitor, in conjunction with a 0.1uF ceramic or polyester capacitor.

A four digit common-cathode LED display is required, and several options are available here. For the author's prototype, a National Semiconductor multidigit display type number NSB7881 was used. This has four 0.7in digits mounted on a common PCB. Similar units with 0.3in and 0.5in high digits are also available, coded NSB3881 and NSB5881.

A similar unit by Fairchild is available from Dick Smith Electronics, and was advertised in the March 1979 issue, at the very reasonable price of $4.95. The third alternative is to construct the display from individual seven-segment displays, such as the LT303 or TIL313 devices.

The 7 segment outputs of the 4511 are connected to the commoned segment lines via 82 ohm current limiting resistors. The four common cathode digit lines from the display are driven by BC337 switching transistors. BC548s could be substituted if required. Base signals for the transistors are developed from the remaining four "D" output port bits, bits 4 to 7 inclusive.

As you can see from the photographs, the prototype was constructed on a small piece of Veroboard, and connected to the computer by a short length of rainbow cable. It is not necessary to use a socket for the 4511, just exercise the normal precautions during soldering. Refer to the November 1978 issue for details of wiring the connector to the computer.

The completed display unit can be

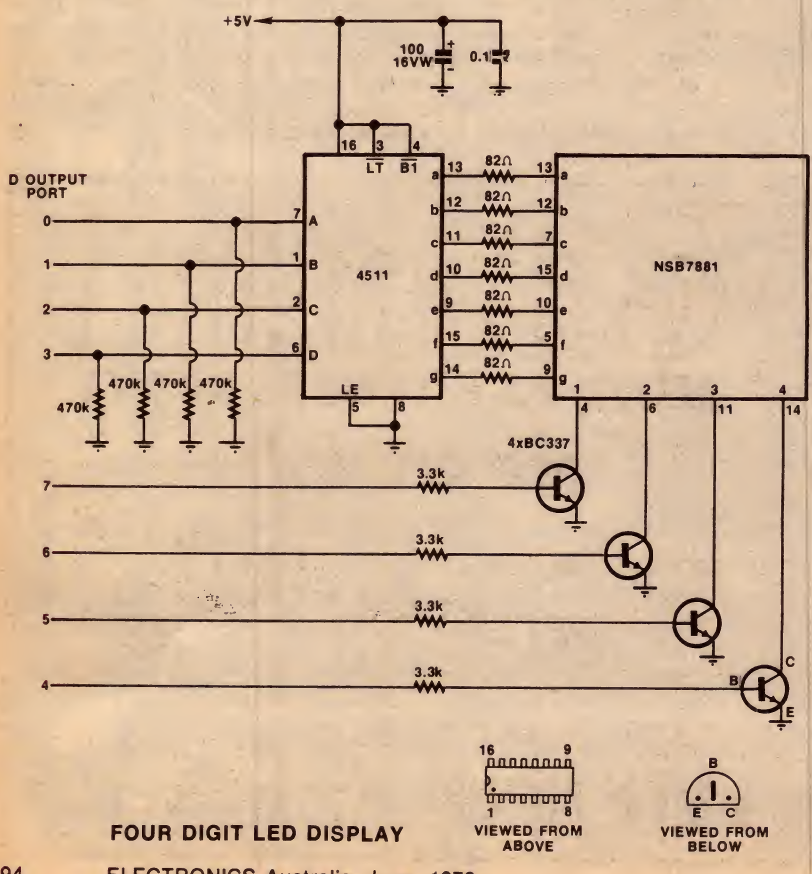
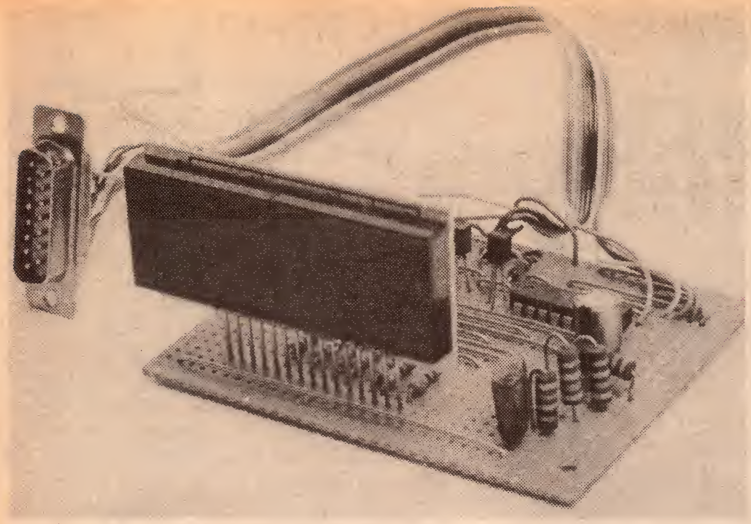
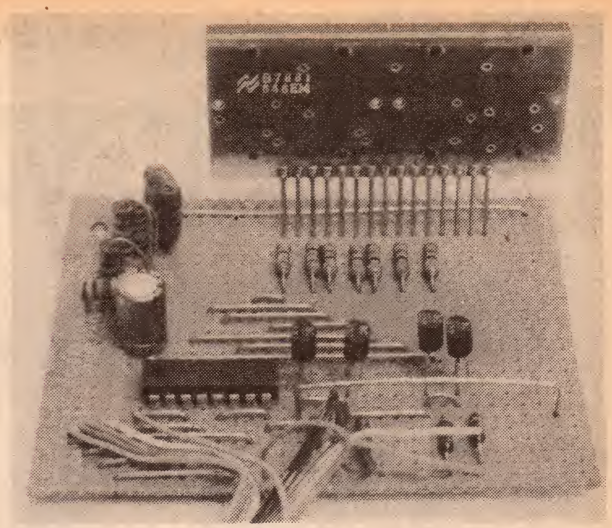


Fig. 1: *The circuit for the author's software-driven four digit LED display. It interfaces to the 2650 Mini Computer via the non-extended "D" output port.*

```
*G1EØØ 44Ø 459
Ø44Ø 76 4Ø        PPSU 4Ø
Ø442 75 18        CPSL 18
Ø444 Ø4 82        LODI,RØ 82
Ø446 FØ           WRTD,RØ
Ø447 F9 7E        BDRR,R1 Ø447
Ø449 Ø4 46        LODI,RØ 46
Ø44B FØ           WRTD,RØ
Ø44C F9 7E        BDRR,R1 Ø44C
Ø44E Ø4 25        LODI,RØ 25
Ø45Ø FØ           WRTD,RØ
Ø451 F9 7E        BDRR,R1 Ø451
Ø453 Ø4 1Ø        LODI,RØ 1Ø
Ø455 FØ           WRTD,RØ
Ø456 F9 7E        BDRR,R1 Ø456
Ø458 1B 6A        BCTR,UN Ø444
```

Fig. 2: A listing of the small routine written by the author to demonstrate the LED display.

The photographs above show two views of the prototype display built by the author on a small piece of Veroboard. The wiring is not critical.

```
0440 76 40 75 18 3F 02 DB 77 08 75 21 08 0C 82 94 C2
0450 E6 60 1A 20 06 00 75 20 04 67 81 94 C1 E5 24 1A
0460 19 05 00 C0 77 10 05 51 06 1D 3B 1D F9 7C FA 7A
0470 75 10 1B 53 04 05 F8 7E C0 C0 1B 68 50 50 50 50
0480 44 0F 17 F0 04 DC F8 7E 17 75 18 01 3B 6E 64 80
0490 3B 71 01 44 0F 64 40 3B 6A 02 3B 60 64 20 3B 63
04A0 02 44 0F 64 10 3B 5C 77 10 C0 17
```

Fig. 3 (left): A HEX LISTING OF THE TIME program, which turns the 2650 and display into a 24-hour clock.

tested before connecting it to the computer. Connect +5V to the board, and observe the display. No numerals should be visible. If any are, switch off, and check the wiring associated with the four transistors. Assuming all is well, use a clip lead to connect the number 4 input bit to +5V. The right-most digit should now read "O", with all other digits off.

By applying +5V to inputs 5, 6 and 7 in turn, you should be able to make the digits read zero in turn. If you want to, you can apply BCD codes to the inputs of the 4511 by pulling the appropriate pins high, and check that the appropriate digits are displayed. However, if you were like the author, you will want to see the computer operate the display, and will not bother to carry out this test.

Fig. 2 is a listing of a small program which will exercise the display. It is completely relocatable, and can be stored anywhere in memory. The first address is the starting address. The program assumes that the display unit is connected to the D output port.

The program repeatedly writes four data bytes to the display, with a small delay between each successive write. The first data byte is X'82, and this displays the numeral 2 in the left most digit of the display. The nybble "8" (binary 1000) turns on this digit, while the nybble "2" is decoded by the 4511 to produce the seven-segment code for the numeral 2.

Similarly, the second data byte (X'46) displays a 6 in the 2nd digit from the left, and so on. The delay between each WRTD instruction, produced by the BDRR, R1 instruction, is necessary in order to provide a glitch free display. Without this delay, all segments of the display tend to glow, due to inherent circuit delays caused by stray capacitance.

You can change the number displayed by altering the lower four bits of locations X'445, 448, 44F and 454. To turn a selected digit completely off, use a non-BCD number such as X' A to F.

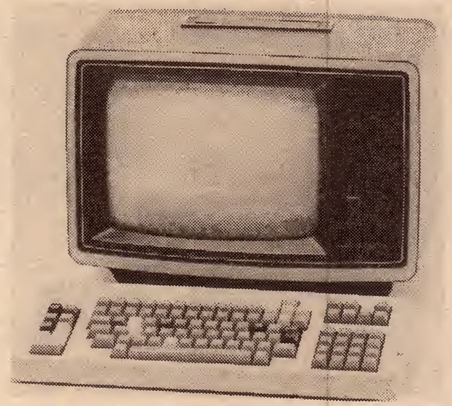
The second program presented here is shown as a hex listing in Fig. 3. It occupies locations X'440 to 4AA inclusive, and is again completely relocatable. It is called TIME, and will make the computer and display unit appear to be a 24 hour clock. It uses the Pipbug routine GNUM to get an initial starting time from the line buffer.

To call the program, type G440 AABB, where AA is the current time in hours (e.g. 20 if it is 8PM), and BB is the current number of minutes past the hour. Do not press the carriage return key until the current minute has ended; the time displayed will then be correct to the nearest second (provided you press the cr key precisely at the 60 second time).

The program assumes that the CPU oscillator is running at exactly 1MHz. Changing the contents of location X'467 by one will vary the timing by approximately one part in 10,000. If location X'467 is incremented, the clock will slow down. To return to Pipbug, press the reset switch.

Microcomputer News & Products

Compucolor II now in Australia



Anderson Digital Equipment, representatives for the US Compucolor Corporation, advise that they now have stocks of the new Compucolor II high-performance personal computer system. Features of the system include integral 33cm colour CRT monitor and mini floppy disc drive, 16K or 32K bytes of user RAM, and system software providing extended DISC BASIC in ROM, full colour graphics, disc file handling, RS-232 driver for a printer or modem, and utility programs like a test editor and 8080 assembler. A range of pre-programmed diskettes are available with games, etc.

Options available with the Compucolor II systems include a second mini floppy drive, expanded keyboard and deluxe keyboard. An additional 16K RAM modification is also available to convert the 16K model to 32K. Both models are provided with a 50-pin expansion connector for future expansion.

Price of the 16K Model 4 Compucolor II system is $1995, with the 32K Model 5 costing $2395. The additional disc drive is $495. All prices include import duty and 240V/50Hz conversion.

Further information is available from Anderson Digital Equipment Pty Ltd, P.O. Box 294, Ryde NSW 2112. Telephone (02) 808 1444.

8K static RAMs

Two new 8K static RAM devices have been released by Mostek, and are available from local Mostek agents Amtron Tyree. The MK4801 and MK 4118 are both organised as 1K x 8 bits, making them very well suited for microcomputer applications. They are both in 24-pin DIL packages with a pinout compatible with existing Mostek ROM and EPROM devices, for further system flexibility.

The MK4801 is a special 100ns device for high speed cache and buffer memory applications, while the MK 4118 is designed for standard microcomputer applications requiring access times of 120-250ns. Both devices use Mostek's Poly-R N-channel silicon gate technology and are TTL compatible. They feature an optional address latching function.

Further information is available from Amtron Tyree Pty Ltd, 176 Botany Street, Waterloo NSW 2017. Telephone (02) 698 9666.

Club in Geelong . . .

We have been advised that a computer club was formed in Geelong in October, 1978, and is now well established. The Geelong Computer Club meets on the second Thursday of each month at Tybar Engineering, Hampton Street Newtown, Geelong Victoria. The club contact is honorary secretary/treasurer Ian J. Stacey, c/o P.O. Box 93, Geelong 3220, or telephone (052) 22 1455 in business hours.

. . . and in SA

A Users' Group for Tandy TRS-80 users has been started in Adelaide, with meetings held on the first Thursday in the month at the local Tandy store. The contact is Mr R. G. Stephenson, 34-36 Sturt Street, Adelaide SA 5000, or telephone (05) 51 5241. Meetings are not formal, more in the nature of a friendly "get together".

Wire-wrap board

A new wire-wrap board compatible with Motorola Exercisor systems is now available from Pennywise Peripherals. To minimise noise, which can be a problem on such boards, the layout is based on recommendations by Telecom arising from research on "Noise in Digital Systems".

The PCB has the standard Motorola micromodule dimensions of 248 x 153mm and has all holes through-plated for maximum pad anchorage. It has provision for card ejector levers if desired. Either 0.3in or 0.6in spacing DIL packages can be accommodated. The board is priced at $46.70 plus 15% tax if applicable.

Pennywise Peripherals also advise that its M4-16 16K byte static RAM card is now available in two speeds: 300ns or 450ns. The cards use low-power 2114

devices and consume only 1.2A when fully loaded. The firm's 2708 programmer card has also been upgraded, with plated-through holes and solder resist on both sides. An application note is also available explaining how to program triple-supply 2716 EPROMs using this programmer.

Further information is available from Pennywise Peripherals, 19 Suemar Street, Mulgrave, Victoria 3170.

Commodore PET

The Commodore PET desktop computer is to be marketed in Australia by the Business Equipment Division of Hanimex Pty Ltd. It will sell for about $1500, around the middle of the price range for personal computers now available here. Hanimex is anticipating healthy sales, as 25,000 PET systems were apparently sold in the USA last year. Some 200 applications programs are now available for use on PET systems, written in BASIC; 140 of these are for small business use.

Cromemco dealer

Adaptive Electronics has announced that it is now a dealer for the Cromemco range of microcomputer systems and peripherals. Cromemco offer an advanced range of S-100 microcomputer systems and components based on the Z-80 microprocessor, and suitable for applications in business, education, process control, word processing and scientific or engineering computing. Cromemco systems available range from the small Z-2 system intended for EPROM-based dedicated control applications to the advanced System Three, incorporating up to four 8-inch floppy disc drives and sophisticated disc protection. A wide variety of system and application cards is also available, all to S-100 standards. Recent additions to the range include a 64K byte RAM card, a 32K byte EPROM card with programming facility, and an optically isolated 4-port I/O card for power control.

Further information on the Cromemco range of systems and products is available from Adaptive Electronics Pty Ltd at 77 Beach Road, Sandringham, Victoria 3191.

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A cutterhead uses a moving coil system to inscribe music onto a master record. With a moving coil playback cartridge you "extract" the music in the same way. This direct "unravelling" of the music explains, in part, why the moving coil cartridge reproduces musical sound with unparalleled accuracy.

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HA119/78

Especially for the AUDIOPHILE

by NEVILLE WILLIAMS

Reviewed below are several discs which should be of special interest to dedicated audiophiles. All are direct cut; one is a test and demonstration disc from Ortofon, one is recorded at 45rpm and the other has been acclaimed overseas as one of the best-ever recordings of a concert organ.

First off, and of special interest, is a direct-cut test and demonstration record produced by Ortofon of Sweden. While it would be a handy disc to have in an audio lab, it is primarily intended to be used in the home by the enthusiast who is keen to check the operation of his amplifier system.

ORTOFON PICKUP TEST RECORD. Stereo, direct cut, number 0001. Side 1, tests. Side 2, music from the Concert Hall of the Tivoli Gardens, Copenhagen.

The disc comes in a double-fold jacket, with general notes on the inside face and a separate brochure which explains what the tests are all about.

It is interesting to note from this brochure that Ortofon has been in the audio business for over 60 years, dating from the time when its founders, Axel Petersen and Arnold Poulsen developed what they claim to be the first sound film projection system. The patent rights were sold in America.

In the thirties, the Company developed a line of high quality disc cutting heads utilising the moving coil principle.

In the forties, Ortofon engineers succeeded in reversing the concept to produce the first of a series of moving coil pickups, which were accepted enthusiastically, the world around. Moving coil pickups still feature in the Ortofon range but they have been supplemented by magnetic cartridges and a variety of other associated products.

Now comes the test record produced of course, with Ortofon equipment and utilising the latest direct cut techniques.

Side 1 is devoted entirely to test tracks. Each is separate, making it necessary to move the head manually from track to track. This is something of a nuisance but, without a tape master, and working from instrument set-ups, a continuous direct cut spiral would be fiendishly difficult to arrange, if not impossible!

Track 1, introduced by a gentle female voice (how agreeable) carries white noise, and is intended to check for correct left/right channel connections, channel balance and channel phasing. In use, it would present no problems for an experienced audiophile.

Track 2 allows the listener to judge whether the overall channel separation is less, equal to, or greater than 20dB, 25dB or 30dB. It uses a broadband signal filtered down to a 316Hz bandwidth and centred on 1kHz. Again relying on the listener's ears, it gives a quite positive indication.

The signal-to-noise ratio of the entire system can be assessed with the next track, which offers white noise in graduated steps down to minus 60dB. The notes warn that the recording system itself tends to mask the difference between —50 and —60dB as also will any turntable rumble, amplifier noise and hum, and general household background.

Track 4 is a silent, unmodulated groove, cut with a locked stylus to ensure freedom from recording amplifier noise. Virtually all noise heard when this groove is played would originate from the playback chain.

Track 5 provides an unusual test, reflecting on the quality of the stylus and cartridge, tracking conditions and linearity within the preamplifier. High frequency tones (20kHz to 7kHz) in pairs 1kHz apart are recorded together and pulsed alternatively with a 1kHz reference tone. If the high frequency tones intermodulate heavily, the resultant will dominate the reference tone to produce a dash-dot (Morse N) signal. if intermodulation is slight, dot-dash (Morse A) will be heard.

Cartridge tracking ability, horizontal and vertical, is probed by a 315Hz signal at various levels in tracks 6 and 7, while 8 and 9 allow the user to check for arm/cartridge resonance. Ortofon engineers nominate 10-12Hz as the range in which the resonance should centre, with the added observation that it should also be well damped.

Contrary to usual practice, the disc provides no frequency runs or bands. Apart from lack of space on the disc, Ortofon engineers may well have reasoned that they can be more of a hindrance than a help in subjectively assessing high quality equipment. At low frequencies, subjective loudness is dominated by standing waves in the room while, at high frequencies, the hearing acuity of th listener becomes a limiting factor.

But, frequency tests notwithstanding, the tracks provided on the Ortofon disc allow the listener to check and adjust his amplifier system in a number of important respects.

Side 2 of the disc is a live, on the spot recording of the Tivoli Symphony Orchestra in the concert hall of Copenhagen's Tivoli Gardens. Featured are a variety of compositions by Christian Lumbye, who was often referred to as "Scandinavia's Strauss". It is pleasant, lilting music, easy on the ear, and with a wide range of instrumental tone colour.

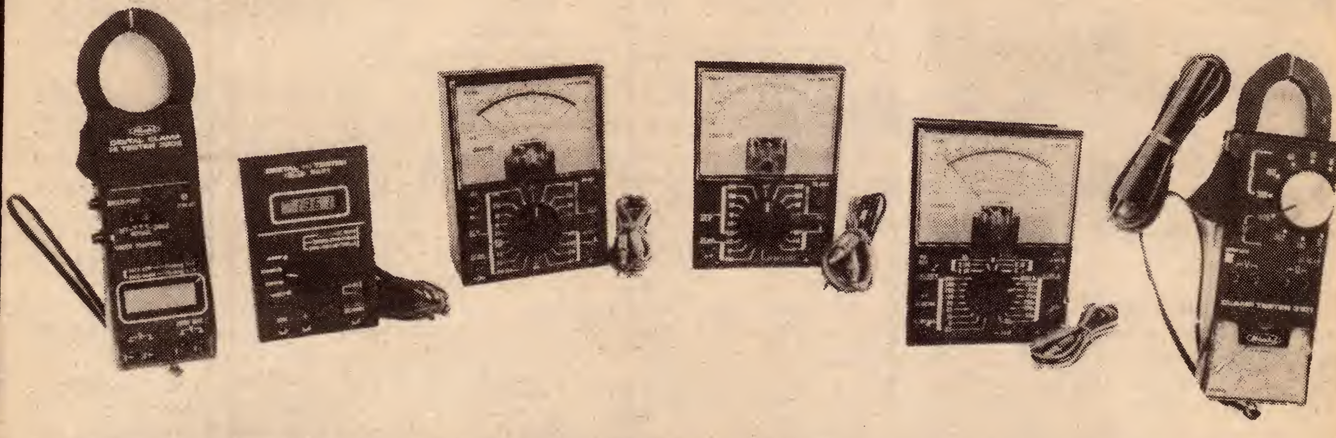
The quality of reproduction is first rate — as it should be. The special Ortofon cutting head and stylus, designed originally for CD-4 quadraphonic, is driven by a 500W amplifier and is within plus and minus 0.5dB of the target response from 10Hz to 26kHz. With microphones covering way beyond this range again, the only artificial restriction was a 6dB per octave filter below 15Hz, to minimise possible sub-audible modulation on the groove.

Ortofon is represented in Australia by Harman Australia Pty Ltd, but the disc can be obtained through Ortofon stockists in all states. The recommended retail price is $17.00.

CLASSICAL RECORDS

Julian Russell, who prepares our monthly review of classical recordings, was taken ill, involving a stay in hospital. He is now recuperating but, until he is well again, his column will be taken over by Paul Frolich.

Hioki
Dependable Multitesters



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0.5/10/250mA DC ±3%
10/50/250/1000V AC 2k Ω/V ±3%
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10A AC ±4%
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L.F. Output —20 to +36dB

3010 HIGH SENSITIVITY (10μ A OPERATING CURRENT) TESTER WITH RELAY PROTECTION
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10/50/250/500/1000V AC 10k Ω/V ±3%
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L.F. Output —20 to +36dB

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2.5/5/10/25/50/100/250/500/1000V AC 10k Ω/V ±3%
25μ /50μ /100μ /250μ /2.5m/25m/250mA/2.5A/10A AC ±3%
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L.F. Output —20 to +36kB

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DIRECT-CUT CLASSICS IMPRESS

BEETHOVEN. Piano Sonata No 23 in F Minor, Op 57, "Apassionata". Ikuyo Kamiya. Stereo, direct cut, 45rpm. (From M. R. Acoustics, P. O. Box 165, Annerley, Qld 4104. Also from specialty record stores. Price $19.00)

According to the jacket notes, this recording was made in February 1977, in the Iruma Public Hall (Japan) and using a German Bosendorter Imperial grand. Produced by the Victor Company of Japan, it was released in America through RCA — an ironic twist because it was RCA who, in the early days of microgroove recording fought to have the industry standardise on 45rpm. In the event, RCA got their way with 7-inch singles and EPs but albums gravitated to 33rpm, with the support of CBS, Decca and others.

With direct cuts, it is not possible to pre-monitor the program for purposes of automatic groove spacing. Because of this restriction JVC engineers point out that the playing time for a 45rpm direct cut is limited to 10 to 12 minutes per side. On the other hand, the higher speed markedly reduces the steepness of transient wavefronts, giving about 5dB of extra "headroom" for transient peaks, for a given level of distortion.

On this disc, side 1 carries Allegro assai and side 2 Andante con moto and Allegro ma non troppo.

The performer may not be well-known to many but is a Japanese woman in her early thirties who has won acclaim in both her own country and in Europe. She displays an impressive amount of physical resource at the keyboard.

Some may note minor stylistic details in the performance, at variance with European traditions but the fact is that JVC and RCA have entrusted her with the program content of a disc that, for its production, required an enormous logistic effort.

As the notes point out, dismantling, transporting, installing and setting up a precision transcription lathe and drive amplifier is a very different proposition from handling even a top quality tape recorder.

As a recording, it is tremendously impressive. As distinct from the purist approach of twin microphones only, JVC engineers used another four in the body of the auditorium to capture the right amount of ambience. As a result, the piano has a powerful presence but is enriched by ample natural ambience.

The dynamic range is outstanding and absolutely demands a quiet listening room, free from traffic and household noises if you are going to listen through the quiet passages, without ear shattering fortissimos or knob twisting — which would defeat the whole concept!

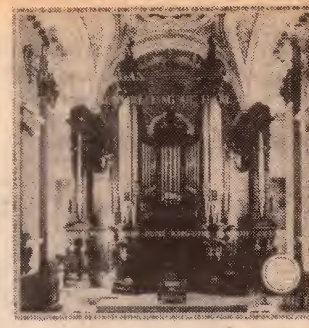
The beauty of it is that the quiet passages are unspoiled by background or surface noise, while the fortissimos remain completely clean, with hard, biting transients.

This indeed is a show disc that should entertain the ears of any audiophile!

CONCERT ORGAN

MICHAEL MURRAY at the Great Organ in the Methuen Memorial Music Hall. Stereo, direct cut. Telarc 5036B. (From P. C. Stereo, P. O. Box 272, Mt Gravatt, Qld 4122. Also from specialty record stores Price $19.50 posted).

The organ featured in this album was originally installed in the Boston Music Hall in 1857-63 by E. F. Walcker of Ludwigsburg, Germany. As such, it was the first full concert organ to be installed in the USA. However, dispite its



popularity it was removed from the Hall in 1884 to make way for the Boston Symphony Orchestra and was stored for the next 13 years. In 1897 the organ was purchased by E. F. Searles, who built a special hall to house it at Methuen, about 20 miles from Boston city.

The Hall later passed to public ownership and, in 1946, the organ was revised and modernised by the Aeolian-Skinner company. Now with its 84 stops, 115 ranks and 6065 pipes — including a recently added reed chorus — it ranks as one of the fine organs of America.

The featured organist is Michael Murray, pictured as a young man, with an already extensive musical background and currently the Municipal organist of Cleveland. He is credited by one overseas reviewer as having "the fleetest fingers and feet in the business". Certainly, he finds no

difficulty here in coping with a classic-romantic program, with French leanings in a building which, in its interior at least, is rather reminiscent of a segment of a French cathedral:

Toccata in F-Major, 5th Symphony (Widor) — Meditation from 24 Pieces in Free Style (Vierne) — Final from the First Symphony (Vierne) — Psalm XIX (Marcello) — Claire de Lune (Karg-Elert) — Final Op. 27, No. 7 (Dupre) — Prelude from 24 Pieces in Free Style (Vierne).

The mic. placement is excellent, capturing not only the source sound but the ambience of what is regarded as a particularly appropriate environment for a concert organ.

What is especially noteworthy, however, is the dynamic range of the recording, from powerful peaks to passages that are so delicate and so remote that you will need a quiet listening room to stay with them.One gets the impression that the team of young men behind this disc — organist, producers and sound engineers — have been keen to emphasise a point. The result is dramatic but it is debateable whether the total dynamic range in a dedicated space like a cathedral or concert hall is appropriate to th practical environment of a domestic listening room.

But arguments aside, this is a fine performance and a dramatic original recording, with clean, noise-free copies produced in Germany.

Birds, animals, homo sapiens — and electronics!

INVESTIGATING MUSIC. A 170-page edited transcript of four ABC radio programs edited by John Merson. Also a cassette containing music illustrations used in the broadcasts. Price for the book $4.45, for the cassette $6.45, both including postage from: The Cashier, ABC, GPO Box 487, GPO Sydney 2001)

I did not hear this series of four broadcasts myself, but it was reportedly very popular; hence the book and cassette. Anyone who wants to assimilate the information in this form will obviously have to work harder than would be the case when merely listening. However, the important thing is that the information is accessible.

The idea is to read the book, which is set out largely in the form of discussion between panel members, with questions or requests picked out in italics and the responses in normal face. Every here and there are footnotes which suggest resort to the tape to listen to the various sound illustrations.

Wisely, the producers of the tape have included segments of the discussion, such that the tape can be replayed at any time with in-built clues as to what it is all about. The sound excerpts have obviously been collected from a variety of available sources and, besides being in mono, are often indifferent in quality. However, they serve the purpose.

I did not have time to read the book through, but I did read some and scan the rest, while listening to the entire tape.

Contrary to what one might expect, "Investigating Music" is not primarily concerned with the structure of western music: notes, harmonics, scales, rhythms, etc. It is assumed that the listener is already reasonably conversant with such matters, at least by way of terms and definitions.

The panel — or more correctly, the panels — cover four general aspects: Music, Language and Perception; Social Functions of Music; Music, Class and Culture; Technology and Musical Education.

Under the first heading, considerable attention is paid to the sounds made by birds and animals and their possible connection with the music of man. Section two looks at music in those cultures where it is still closely related to activities, as distinct from whim or entertainment.

Section three investigates the relationship of music and western civilisation and the degree to which each has modified the other. This leads into the fourth and final section which is heavily involved with electronically generated sound. Attention is focussed on the Australian developed "Qasar", which might be described as a computer controlled synthesiser.

As I said earlier, "Investigating Music" is a book/cassette combination that one needs to work at, but the audiophile may well find it an enriching background to his immediate involvement with hifi technology and direct-cut discs or grand pianos and concert organs.

Lighter Side

Reviews of other recordings

Classical organ music from British cathedrals, Kings College

ELGAR: The great First Organ Sonata, and organ music by Bliss, Vaughan Williams, Britten and Malcolm Williamson. Stereo, World Record Club R 04973.

A collection of 20th century organ music by four English composers and "honorary" English composer Malcolm Williamson — born in Sydney. The major work is Elgar's Organ Sonata No. 1 in G major, played by Herbert Sumsion at the organ of Gloucester Cathedral. Bliss is represented by his three Fanfares composed for the wedding of Princess Margaret in 1960; Vaughan Williams by his Three Preludes on Welsh Hymn Tunes; Britten by his Prelude and Fugue on a theme by the Spanish composer Vittoria; and Williamson by his Two Epitaphs for Edith Sitwell.

The organs are all of a high standard, and the organists well known. Christopher Dearnley plays the Bliss fanfares in St. Paul's Cathedral, Robert Joyce the Vaughan Williams preludes in Llandaff Cathedral, Herrick Bunney the Britten prelude and fugue at Edinburgh's St. Giles Cathedral, and Allan Wicks the Williamson epitaphs at Canterbury Cathedral.

Whether or not you enjoy this record will probably depend on the degree to which you can identify with the music. While Elgar is generally not my cup of tea, I found Sumsion's playing of the first sonata gave me new insights into the work, and most enjoyable. Allan Wicks' playing of the Williamson pieces I also found very satisfying, but the other three organists either use a little too heavy registration for my taste or they are not recorded to best advantage.

In short, I would suggest that you listen to this one before making up your mind. (J.R.)

☆ ☆ ☆

ORGAN MUSIC FROM KING'S. Philip Ledger at the organ of King's College, Cambridge. Stereo, World Record Club R 05216.

Philip Ledger was the youngest Cathedral organist in England when he was appointed to Chelmsford Cathedral in 1961. Since 1974 he has been Director of Music at King's College, where he plays on this recording. The pieces he plays are all well-known and often played, but he brings to them a down-to-earth freshness which makes the recording both interesting and enjoyable.

The first work played is that venerable war-horse, J. S. Bach's Toccata and Fugue in D minor — surely the most often-played and often-badly-played of all organ works. Yet by skillful registration, sensitive phrasing and careful control of pace, Ledger manages to make it sound remarkably fresh. Quite a contrast against the many "renditions" of this work which sound as if the organist is either worried about missing the last train home, or is solely concerned with demonstrating how fast his fingers can move without leaving his hands!

The remaining pieces are all from the romantic school: a Chorale Prelude by Brahms, Liszt's Prelude and Fugue on B-A-C-H, the second of Vaughan Williams' Three Preludes founded on Welsh Hymn Tunes, Cesar Franck's Choral No. 3 in A minor, Louis Vierne's Berceuse and Widor's "celebrated" Toccata from his Symphony No. 5. In all of them Ledger displays the same skill and sensitivity. The registrations seem just right, and the tempi chosen with great care to bring out the best from each movement.

The recording is of a high standard, too, giving a most satisfying reproduction of the historic King's instrument — parts of which date from 1605.

All in all, then, a most interesting and enjoyable recording of familiar organ works played uncommonly well. (J.R.)

New Devotional Records

GARY S. PAXTON. Terminally Weird But Goodly Right. Stereo, Pax R-2406. (Fram Sacred Productions Australia, 18-26 Canterbury Rd, Heathmont, Vic 3135)

In his own jacket notes, Gary Paxton says that he anticipates that the style of this album will alienate many traditional christians but, while he regrets this, his prime aim is to communicate with those who, in turn, are alienated by traditional Christian music.

The sound varies from rock, through gimmicked C&W to a soul version of "Blessed Assurance"; Certainly well removed from normal devotional music. Yet the words, set out in full in the double fold jacket, pull no punches in challenging materialistic values:

I'm Anchored In The Rock Of Ages — Lord How'd I Get So Old So Fast? — Mental Pollution — Ode To The Outlaw (That Prison Called Freedom) — Can't See Me Serving Nobody But Jesus — Will There Be Hippies In Heaven? — Blessed Assurance — Progress (Fun Loving Progress) — Fat, Fat Christians — The Clone Affair — The Big A, The Big M.

If your preference is for comfortable, familiar devotional melodies, this is not for you. But if you're prepared to listen to and consider a multi-pronged

challenge to you and your stereotyped group listen to what Gary Paxton has to say! (W.N.W.)

☆ ☆ ☆

COMMUNION — A singalong for God's people in harmony. Stereo, Birdwing BWR-2009. Released in Australia through Spotlight Music Pty Ltd, 262 Pitt St, Sydney 2000).

For decades, chorus singalongs have been a prominent feature of Gospel rallies — originally catchy choruses of actual hymns but, more recently, with an increasing content of new compositions. In fact, they can be as much a problem to keep up with as pop songs!

For example, although there are over 40 excerpts and choruses on the four sides of this singalong medley, the chances are that you won't recognise any or many of them. You needn't worry, however. They follow the usual pattern of being tuneful and varied and the diction is excellent. So also is the quality of the sound off the disc.

They are presented in close harmony by a vocal group, with instrumental

Reviews in this section are by Neville Williams (W.N.W.), Jamieson Rowe (J.R.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), David Edwards(D.W.E.), Greg Swain (G.S.), and Danny Hooper (D.H.).

backing including piano, organ, drums and synthesiser. You can let the group-singalong for you in a quiet, relaxed manner, or turn the volume up and enjoy it that way — or join right in with them!

The disc could suggest new material for your own group singalong activities and, in this connection, a label on the jacket suggests that a book of music and lyrics is available. There is also mention of an open-reel tape and two cassettes which carry the musical accompaniment only. (W.N.W.)

For information on World Record Club albums, contact the club at 605 Camberwell Road, Hartwell, Victoria, 3124. Tel. 29 3636.

Instrumental, Vocal and Humour

THE JAZZ SOUND OF THE DON BURROWS QUARTET. World Record Club stereo WRC RO5193.

I have an original copy of this album some 14 years old which is one of my firm favourites. (Originally it was released on Columbia.) The re-release with WRC is every bit as good and can still be classed as a first class recording. Surface noise is low.

There are nine tracks: Kaffir Song — Love Is For The Very Young — Esa Cara — Slightly Blue — Hard Sock — Rain On Water — De Veras? — Algeciras — Pink Gin. (L.D.S.)

☆ ☆ ☆

SONGS FOR SWINGIN' SELLERS. World Record Club stereo WRC R 05229.

Fans of Peter Sellers, who might be thought of as a Goon who grew older, will be keen to listen to this album. As can be expected of Peter Sellers it is unmitigated nonsense, which is all very clever. Unfortunately, none of it struck me as being particularly funny. Perhaps I should have reviewed it while semi-intoxicated! (L.D.S.)

SHOWBOAT. Music by Jerome Kern, lyrics by Oscar Hammerstein II. Cast recording from the Adelphi Theatre, London. Stereo, World Record Club RO-5022.

Although this recording reached me through the World Record Club catalog, the pressing and jacket appear to be as originally distributed by Columbia. As such, they probably date back to the 1971 era, when the particular show opened in London. It featured Andre Jobin, Cleo Laine, Thomas Carey, Kenneth Nelson and Derek Royle.

The show was acclaimed at the time for its sheer spectacle and the album will be most meaningful to those who have seen this or another production. To those who haven't, the album will have to stand or fall by the numbers which, together, add up to a generous recording time of nearly 50 minutes: Cotton Blossom — Where's The Mate For Me? — Make Believe — Can't Help Lovin' Dat Man — I Might Fall Back On You — Ol' Man River — Queenie's Ballyhoo — At The Fair — Nobody Else But Me — How'd You Like To Spoon With Me? — You Are Love — Bill — Dance Away The Night — Why Do I Love You? — Ol' Man River.

It's a typical cast recording, not note perfect but carrying the atmosphere of the stage production. The recording quality is normal and, if you like the music, this will be an opportunity to enjoy it all over again. (W.N.W.)

EDWARD WOODWARD, The Thought Of You. Festival L 36717.

I like Edward Woodward better as a singer of ballads than as the rather unpleasant "Callan" of the TV series.

On this disc he gives us a dozen superbly sung tracks: Can't Smile Without You — Time In A Bottle — You Are Beautiful — The Folks Who Live On The Hill — Smile — The Party's Over — I'm Old Fashioned — Growing Older Feeling Younger — I've Told Every Little Star — Love Look At Us Now — The Very Thought Of You — Evergreen. The backing is provided by an orchestra under the direction of Johnny Arthey.

Quite a few of the tracks have had a fair amount of airplay recently. (NJM)

* * *

BEHIND THE SMILE. Marti Caine. Astor Records SPLP1541.

English Marti Caine gained her big show business break on ATV's "New Faces" when her hesitant brand of humour, combined with some fine singing, took her into the winner's league and a triumphant debut at the MGM Grand Hotel in Las Vegas.

Since her success on "New Faces" Marti has had her own series for ATV and a series for BBC television.

"Behind The Smile" is a brilliant "easy-listening" album with some excellent interpretations of recent hit singles: Prelude — Nobody Does It Better — You — A Weekend In New England — Feelin' Single, Seein' Double — I Honestly Love You — Sometimes When We Touch — I've Never Been To Me — If It's Magic — What's The Weather Like Outside — Sweet Music Man — All In Love Is Fair — Lullaby For Myself. (D.H.)

* * *

15 THOUGHTS OF BRINSLEY SCHWARZ. Brinsley Schwarz. United Artists L 36713. Festival release.

The 15 songs on this album are taken from various albums through the years 1970-1975, the time span that this British Rock Band stayed together before going their own way.

The collection of songs on this album are: Peace, Love And Understanding — There's A Cloud In My Heart — Nightingle — Hypocrik Funk — Angel — I Like You, I Don't Like You — Rockin' Chair — Shining Brightly — Country Girl — Surrender To The Rhythm — Hooked On The Road — Home In My Hand.

This is an excellent album with a variety of style: country, soul, reggae, rhythm & blues and pop. (D.H.)

* * *

UNCLE HARRY LIVES AGAIN

TALES OF MY UNCLE HARRY. Keith Garvey. Dolby System cassette. Also available on LP disc. ($3.95, $4.40 posted from: The Cashier, ABC, GPO Box 487, Sydney 2001).

Keith Garvey, as introduced in the cassette folder, is a true son of the Australian outback and a keen admirer of Henry Lawson. For a couple of years he has featured on the ABC radio network and many will be familiar with his series of "Tales of my Uncle Harry". If you are, and you want a sampling of them, this cassette contains about 16, all told.

On the other hand, if you have merely noticed the item in the programs, without ever having listened, what are you going to hear on this cassette? A half-hour of side-splitting humour? Not unless you're in a particularly receptive mood! Playing a tape like this alone in your lounge room is about as sterile an experience as reading one of those old-fashioned books of jokes. Somehow, you need environment and atmosphere to bring them alive.

Having some first-hand knowledge of the country, it is sufficient for me to say that, while Uncle Harry was a past master of the tall tale, the setting of those tales is in tune with the outback as it used to be. The rest is up to you and your mood. (W.N.W.)

AMATEUR RADIO

by Pierce Healy, VK2APQ

Sydney hosts WARC 79 preparatory seminar — special report by Pierce Healy

As a lead-up to WARC 79 — and second only in importance to the conference itself — there have been three proparatory seminars organised by the ITU; one each in Nairobi, Panama, and Sydney. Your correspondent was privileged to attend the Sydney seminar, and reports some highlights of the formal and informal sessions.

WARC 79, which will commence in Geneva Switzerland in September is expected to have 1600 participants from the ITU's 154 members and will last for ten weeks. The agreements reached regarding the radio regulations will apply for the remainder of this century.

The ITU (International Telecommunications Union) organised the preparatory seminars to familiarise the delegates — many of whom will be attending their first radio conference — with the procedures and requirements involved in bringing up-to-date the 1959 regulations. The Sydney seminar hosted 170 representatives from 37 countries.

Being allowed to observe these preparations in progress was a most rewarding experience, and also a most enlightening one. In particular it brought home the sheer magnitude of the task ahead and, in doing so, emphasised that the Amateur Service is, after all, only a tiny part of the total communications scene to be dealt with.

The magnitude of the task was emphasised particularly by some of the documents circulated at the Sydney seminar. One was a report of the CCIR Special Preparatory Meeting held in Geneva during October and November 1978. In consists of over 600 A4 (295mm x 210mm) pages, in reduced typewriter font, and weighing nearly 1.2kg (over 2½lbs).

Its contents range from broadcast band allocations to satellite TV relays; from standard frequency transmissions to analogue and digital transmissions in the GHz bands; from terms and definitions to allocations for power transmission (in GW) by radio waves from solar satellites.

And this was only a preparatory meeting.

In addition, there was similar order of documents generated by the Sydney seminar, mainly in the form of papers by various delegates. One document alone — A Summary of Discussions (Questions and Answers) — ran to some 60 odd A4 typewritten pages.

The initial session of the seminar was presided over by the Deputy Secretary General ITU, Mr Richard Butler, who welcomed delegates and called for nominations for seminar chairman. Mr E. J. Wilkinson, First Secretary, Radio, Frequency Management, P & T Dept., Australia, was elected to this position.

At the official opening, the seminar was addressed by Mr M. Mili, Secretary General ITU, who referred to WARC 79 and the task it was to perform, and to the technical progress and evolution in the countries themselves since 1959 when there were 96 members of ITU.

Mr A.A. Staley, Minister of Post and Telecommunications in Australia, officially opened the seminar, welcoming the delegates and refering to Australia's involvement in ITU since 1878 and the emphasis Australia places on the subjects to be discussed at the seminar and the keen desire that WARC 79 should be a success.

Thirty-five papers covering many and varying aspects of radio communication were read and discussed by delegates. These included topics of regional interest, terrestial and space services and technical advances leading to a more efficient use of the radio frequency spectrum.

The amateur service was represented on the Australian delegation by David Wardlaw, VK3ADW and Michael Owen VK3KI.

A number of delegates from the countries represented, and serving in various capacities, were also amateurs, as were some of the seminar staff personnel.

Apart from formal discussions, the seminar provided an opportunity for a good deal of informal discussion between various countries and services. Naturally the amateur service made most of its opportunities.

A social function for the delegates, hosted by the Wireless Institute of

Physics master at the Burra Community School, Wally Spehr, VK5PD, at the microphone during the contact with VK2BOK. The transceiver is a Kenwood 820 operating into a parasol beam lashed to a playground swing. (Story, p 111.)

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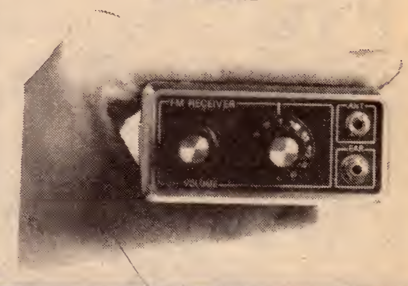

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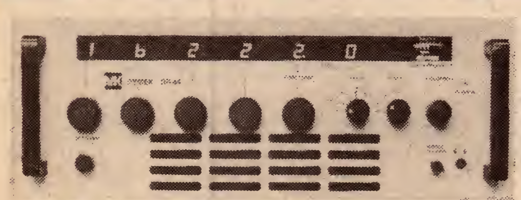

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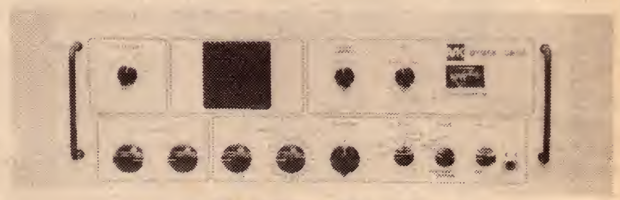
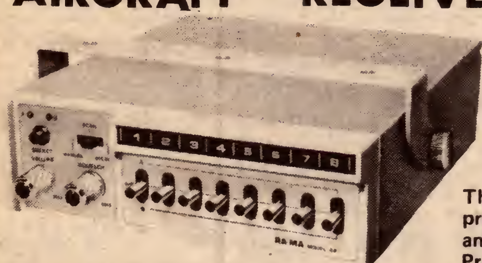


AM SSB CW RTTY

AIRCRAFT RECEIVER



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$199

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JK01	General purpose audio amp 0.5N	18.00
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KIT HF325-2	$79.00
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Perth	321 3047		

AMATEUR RADIO

Australia and the International Amateur Radio Union was held on Saturday evening 31st March.

Apart from generalities, one of the main talking points was the IARU simple low cost direct conversion receiver. A short continuous video tape explaining the amateur radio service was also available for delegates to view at their leisure. Both items created considerable interest.

Away from the seminar environment, several members of the Sydney Chapter Quarter Century Wireless Association were hosts to Richard Butler and Michael Owen, VK3KI, for dinner. The informal discussion on the amateur service and WARC 79 which followed, made the evening a very informative and enjoyable one.

There is no doubt that both the formal and informal discussions helped all the delegates to form a broader view of the problem of equitably sharing the radio frequency spectrum between all services — including the Amateur Service — and all countries. It also emphasised to the amateurs that their allocations are only a very minute portion of the spectrum and only one of a great many subjects on the agenda for WARC 79.

It is ironical in some respects that amateur radio, having been so closely associated in the progress of radio science and communication, finds itself in the situation of having to fight to maintain recognition.

It may be significant however that there was no objection or criticism of the amateur service at the seminar.

Indeed it is thought that many administrations are now, through the unified work of the IARU, more appreciative of the value a responsible amateur service could be. But there is still no room for complacency about WARC 79 decisions.

All amateurs should give their support to their national amateur radio society.

Finally, I would express my appreciation to all associated with the seminar, in particular Mr Richard Butler for his friendly interest and willingness to discuss my inquiries.

SCHOOL DEMONSTRATION

An amateur radio demonstration was given on 5th April 1978 at the Ingleburn High School. The occasion was the "Careers Market Day" held to give final year students first hand information about careers in various trades and professions.

More than 50 information booths and displays were staffed by representatives from manufacturing, banking, legal, health, further education, Army, Navy, RAAF, catering, and communication organisations.

Amateur radio at the Ingleburn High School "Careers Day". Shown holding the microphone is Marcia Robinson, an exchange student from Nebraska, USA, who was able to talk to an amateur in her own country. (See story, this page.)

Over 2500 boys and girls from schools and colleges in adjacent areas visited the centre.

Amateur radio was demonstrated as a means of gaining knowledge and experience in electronics and communication either as a rewarding hobby or to assist a career in the radio or electronics industry.

Several overseas contacts were made during the day, giving those interested the opportunity to ask questions of the operators and their country. A highlight was Japanese language lessons, given by student operators in Japan.

Many students, whose experience in radio communication was limited to CB activity, were amazed at the courteous and friendly manner among amateurs in various parts of the world, and expressed their desire to upgrade to AOCP standard.

The station operators were Pierce Healy, VK2APQ and Athol Tilley, VK2BAD.

This type of public relations activity is recommended as an enjoyable and rearding community service.

WIA NEWS

WIA president and amateur representaive on the Australian delegation to WARC 79, David Wardlaw VK3ADW, has advised that the Australian submission relating to amateur allocations within Australia recommends that all existing channels be retained in their entirety. In addition, a segment 6.95MHz to 7MHz and small segments around 10MHz, 18MHz and 24MHz have been suggested.

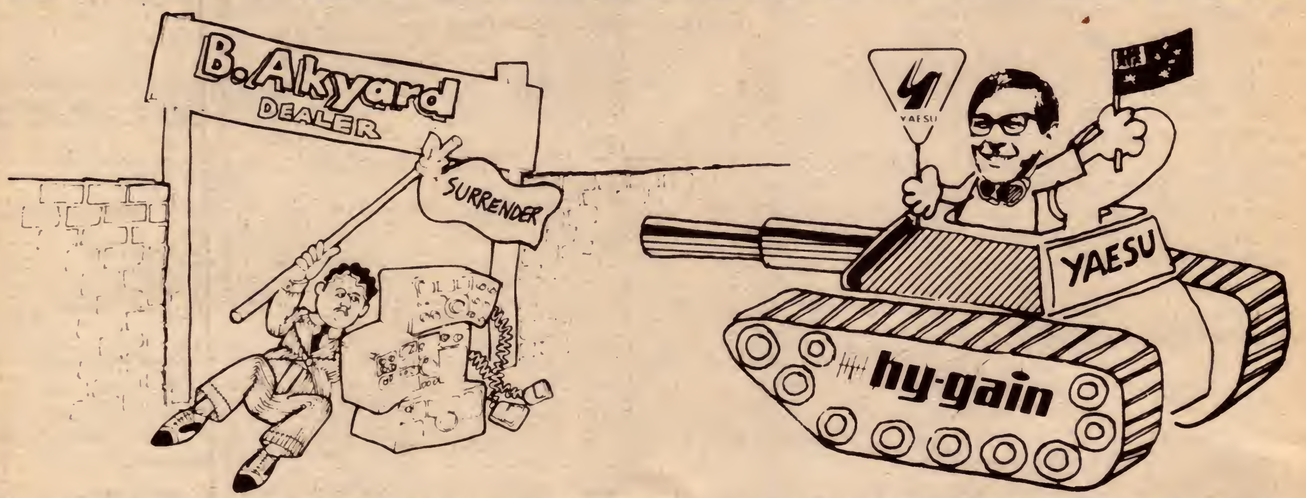
FINANCIAL SUPPORT: The response to the appeal for donations to send the WIA observer to WARC 79 has been very good. Many non-members of the WIA and business organisations have contributed. The outstanding contributions — Eastern and Mountain District Radio Club $1100; VICOM $1000; Bail Electronics $500; Dick Smith Electronics $500.

These donations together with divisional contributions are acknowledged and will be tabulated in a future issue of the WIA magazine "Amateur Radio".

NSW DIVISION: A special general

THE WAR CONTINUES

THE BATTLE STILL RAGES WITH YAESU — NOW HY-GAIN ANTENNAS HAVE FALLEN TOO!



You must have heard about the Yaesu price war – Dick Smith will better any genuine price offered by anyone on Yaesu products . . . We've received such a tremendous response from the Amateurs of Australia that we've decided to reduce the price of Hy-gain HF antennas. So now you can buy your complete amateur station from Dick at a real bargain price.

YOU REAP THE BENEFIT!

And you'll be buying from a fully Australian owned company – your one stop electronics shop who actively supports amateur radio!

HERE ARE OUR YAESU PRICES: (and we'll send them anywhere in Australia for just $6.00 extra – We even lose money on this 'below cost' freight offer!)

FT-101E 80-10m HF transceiver	Cat D-2860	**$789.00**	FT-101Z New HF transceiver	Cat D-2862	**$775.00**
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FT-7 Mobile HF transceiver	Cat D-2866	**$375.00**	FT-227RA 2m FM scanning transc.	Cat D-2891	**$379.00**
FT-227 2m FM transc with memory	Cat D-2890	**$379.00**	CPU-2500 computerised 2m transc.	Cat D-2889	**$549.00**
FC-301 Antenna tuning unit	Cat D-2896	**$219.00**	FC-901 antenna tuning unit	Cat. D-2855	**$249.00**
FL-2100B 1.2kW linear amplifier	Cat D-2546	**$529.00**	FL-110 200W linear amplifier	Cat D-2884	**$189.00**
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FP-301 13.8V/20A supply	Cat D-2872	**$169.00**	YC-500S 500MHz Freq. Counter	Cat D-2892	**$475.00**

We believe that the prices above are better than any supplier in Australia. If you find someone cheaper for the same goods, tell us! For us to better any price, simply show us the advertisment from any Australian company. After checking that they have stocks available at that price we will sell it for a lower price. Offer remains open while present stocks last (approx. $250,000 worth).

Easy terms available to approved personal applicants on any item priced at $111.00 or more.

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SUPER SPECIAL:
TH6 DXX SLASHED BY $104.00 TO ONLY
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SAVE $14.50
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AMATEUR RADIO

meeting called to discuss the proposed sale of Wireless Institute Centre, Crows Nest, and the constitution of the Division, was held on the 23rd March, 1979. The meeting resolved that the incoming council appoint a committee to review the future requirements of the division and the options relating to the sale of the Crows Nest property.

A committee was also appointed to review the constitution and to report its recommendations to a general meeting of the division. This committee consists of Pierce Healy, VK2APQ chairman; Harry Caldecott, VK2DA; Barry White, VK2AAB; Tim Mills, VK2ZTM; Chris Jones, VK2ZDD.

The committee will review the constitution, bearing in mind the views expressed by members on such aspects as the powers of the council, club affiliation, voting rights of members, and proxy votes.

Members wishing to offer suggestions and opinions should do so in writing to the Constitution Review Committee, 14 Atchison Street, Crows Nest 2065.

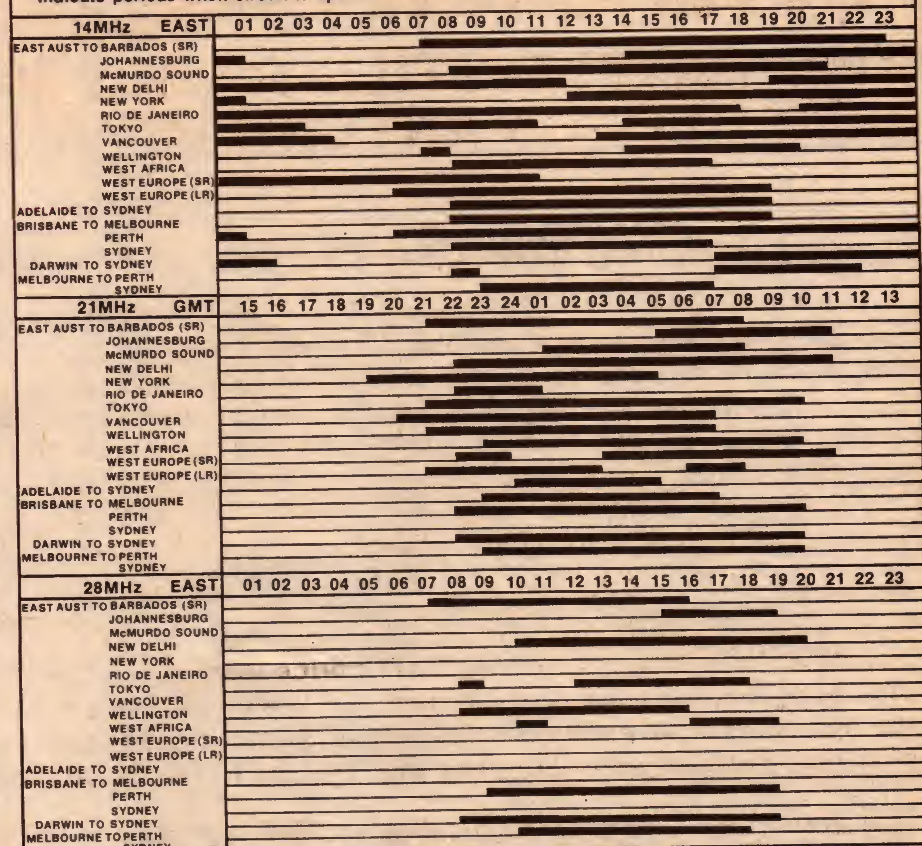
COUNCIL ELECTIONS: There were only seven nominations received and no ballot was necessary. The nominees were — Phil Card, VK2ZBK; Henry Lundell, VK2ZHE; Ian Mackenzie, VK2ZIM; Tim Mills, VK2ZTM; Fred Parker, VK2NFF; Steven Paul, VK2VHP and Eric Van De Weyer VK2ZUR. At their first meeing, Fred Parker, VK2NFF was elected president; Phil Card, VK2ZBK and Ian Mackenzie, VK2ZIM vice presidents; Tim Mills, VK2ZTM secretary.

ACT DIVISION: Office bearers elected at the annual meeting held in February, 1979, were: president — Andrew Davis, VK1DA; vice-presients — Mike Vale, VK1VW and Ron Henderson, VK1RH; secretary — Fred Robertson-Mudie, VK1NAV; treasurer — John Roberts, VK1ZAR; committeemen — John Tilley, VK1FT; Bob Chorley, VK1RC and Les Thurbon, VK1NBK.

Meetings are held on the fourth Monday of each month commencing at 7.30 pm at "The Studio" Griffin Centre, Civic, ACT. Visitors are welcome.

IONOSPHERIC PREDICTIONS FOR JUNE

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 6.79



SYDNEY SCIENCE MUSEUM OPENING CEREMONY

Unfortunately, printing schedules for the May issue limited our report on the above to a photograph and brief comment. A highlight of the ceremony resulted from the first official "CQ" which, quite unsheduled, brought a reply from the Burra Community School, Burra, South Australia, who had set up an amateur station display as part of a school gala day. A letter confirming the contact was received from the physics teacher, Wally Spehr, VK5PD.

"I would like to thank you for such an interesting contact on Friday 23rd March during the opening of the Applied Arts and Science Museum Station, VK2BOK. We were very pleased to be the first station to officially contact the Museum station and to be able to speak with the Federal P&T Minister, Mr Peter Staley.

"The contact certainly gave a boost to our Amateur Radio Display which had been set up as part of the school Gala Day. Those present were impresses with the learning opportunities provided by amateur radio, and the Museum contact really highlighted this. Our principal, Chris McCabe, enjoyed the opportunity to speak with the Muuseum education officer and to tell him about the Burra Community School and the local district.

"I use my own gear in a portable capacity and transmit from the school's science laboratory using a parasol beam constructed by the students.

"Our group is run on an informal basis and meets on the first and third Wednesday of each month from 12.50 to 1.20pm CST. We operate . . . close to 28.560MHz and 14.210MHz and welcome contacts with other stations, particularly other school groups. We have found such contacts to be very educational.

"A few students have expressed an interest in gaining a novice licence and it is hoped that their ambition can be realised.

"Finally, I hope that all goes well with station VK2BOK and look forward to visiting it in the future."

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown 2200.

SHORTWAVE SCENE

by Arthur Cushen, MBE

Sunspots Force The Use Of Higher Frequencies

With the Sunspot count expected to reach 150 next month, international broadcasters are using the 11 and 13-metre bands in an attempt to provide world-wide coverage. One problem facing broadcasters is that many listeners have receivers which do not cover these two bands.

Due to the increasing Sunspot count, most broadcasters are now using the 13-metre band for an international service, while the 11-metre band is being used for the first time by several countries.

The highest frequency previously used by a broadcasting station was 26150kHz by W4XB Nashville, Tennessee in 1939. This has now been surpassed by the Israel Radio with its use of 29705kHz from 0535-0600 and 1000-1030GMT.

Two new countries recently extended their operation into the 11-metre band. Radio France International is now using the additional frequency of 25820kHz from 1000GMT with a broadcast from Paris, while Radio Nederland is using 25650kHz from its Madagascar transmitter for a broadcast in Dutch 0730-0825GMT. In addition, Israel which uses 25605kHz at 0535GMT, has used this frequency for additional programs in recent weeks. The United States is using five frequencies in the 11-metre band both for the Voice of America and Armed Forces radio programs.

The Armed Forces signal is very good from 2100-0400GMT over the Dixon transmitter on 25620KHz, while the Voice of America at 2200GMT is well received on 25990 and 25096kHz.

Radio South Africa continues to use the 11-metre band and has been noted opening at 1100GMT on 25790kHz. The same program is carried on 21535, and both transmitters are beamed to Central Africa and Europe.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add 8 hours for WAST, 10 hours for EAST and 12 hours for NZT.

Fritz Greveling, the new compere of DX Juke Box on Radio Nederland.

NEW JUKE BOX COMPERE

Fritz Greveling is the new compere of Radio Nederland's DX Juke Box program. Fritz replaces Dick Speekman who is returning to Australia after being with the program for 4½ years.

Fritz was born on October 10, 1947 and his early radio career was with Lourenco Marques Radio in Mozambique. Later the station changed its name to Radio Five and moved to Johannesburg, South Africa after Mozambique became independent. He later did freelance broadcasting for Swazi Music Radio, working in their recording studios in Johannesburg. He returned to his native Holland in 1976 where he joined the staff of Radio Nederland as a translator and later as host of DX Juke Box.

DX Juke Box is broadcast every Thursday from Radio Nederland studios in Hilversum, Holland and is well received through the relay station at Bonaire in the Caribbean. The program of 30 minutes includes a weekly DX report and DX Juke Box is broadcast at 0750GMT on 9715 and 9770kHz, and repeated at 0850GMT on 9715kHz. There are other transmissions for various parts of the world both from the relay bases at Bonaire and Madagascar, as well as a transmitter at Lopik in Holland.

The DX information comes from four contributors, The first Thursday of each month features Arthur Cushen's Pacific DX report; Jan Turner reports from Sweden on the second Thursday; Glen Hauser from North America on the third Thursday; and Victor Goonetilleke from South East Asia on the fourth Thursday. The first Thursday of the month also includes a propagation report from Maarten Ven Delft, while on the third Thursday there is a handicap aid program from Fritz Mulder.

TESTS FROM BRAZIL

Radio Nacional at Brasilia operated an International Service for several months but this was closed last year with the transmitter being used for an internal service. In recent weeks the station, now using the slogan Radio Bras, has been heard on 15280kHz with English 0200-0300GMT. This is a test transmission and, according to the announcement, will be on the air for 90 days. Depending on the interest in the new program a permanent service could commence. The frequency is subject to interference from KGEI in San Francisco, also using 15280kHz.

The earlier test transmissions from Brasilia were on 11780 and 15240kHz with English at 2200GMT, but this transmission is beamed to North America. The station is giving a new address for reception reports and this is: Radio Nacional Brasilia, c/- International Correspondence Service, Post Office Box 04-0430, Brasilia, Federal District, 70323 Brazil.

SHORTWAVE SCENE

RADIO AFGHANISTAN

As well as a verification card, Radio Afghanistan at Kabul gives some background information on the history of broadcasting in that country. In Afghanistan, as in other developing nations, radio reaches the largest number of people, far more than the printing press.

Experimental broadcasting began in Afghanistan as early as 1925, when two small broadcasting transmitters were imported to Kabul. Regular broadcasting began in 1940 with a medium-wave transmitter. Later on, the station was equipped with more medium and short-wave transmitters.

Until 1963, the broadcasting station in Afghanistan was called Radio Kabul, but following continued expansion assumed the name of Radio Afghanistan. Radio Afghanistan verifies reception reports with a card, as long as return postage is enclosed and the report covers the usual details required by an international station.

The present schedule of Radio Afghanistan includes two broadcasts in English: 1400-1430GMT on 4775kHz and 1900-1930GMT on 11895 and 15140kHz. Radio Afghanistan broadcasts for 106 hours on medium-wave, while the External Service is carried for 31 hours 30 minutes each week. The address of the station, is Radio Afghanistan, PO Box 544, Kabul. Afghanistan.

NEW LISTENERS CLUB

The Belgium Radio and Television has commenced a listeners club on its short-wave service, and listeners can join by writing to BRT, PO Box 26, B1000 Brussels. There will be special information bulletins for club members, verification cards, stickers and pennants.

The Belgium DX Corner is broadcast on the 2nd and 4th Monday of the month during the English transmission to North America 0015-0100GMT on 11705 and 15190kHz.

NEW ZEALAND SCHEDULE

Radio New Zealand has made some alterations to its schedule for broadcasting to the Pacific, with closedown now being at 1030GMT. The service to Australia continues to be broadcast up to 1215GMT.

Broadcasts to the Pacific are: 1800-2105GMT on 11835kHz; 1800-0625 on 15345; 2115-0815 on 17860; and 0640-1030 on 6105. Broadcasts to Australia are 0830-1215GMT on 11945kHz; and 1045-1215 on 6105. It is expected that this schedule will remain in force up to the last Sunday in October, when there will be a change to daylight time in New Zealand.

NEW MALTA FREQUENCY

Radio Malta, after broadcasting for some months for evening reception in the United Kingdom, now has changed to a morning broadcast which is heard 0700-0800GMT on Saturdays. The frequency used is 9670kHz, and this outlet is noted after the Voice of America closes at 0700GMT. There has been some interference from Radio Australia which is also using the frequency.

The program consists of bright music and a news bulletin at 0705GMT. Requests for reception reports are made during the transmission and these should be sent to Radio Malta, PO Box 82, Valletta, Malta. The station verifies with a letter and also sends a tourist booklet about Malta.

LISTENING BRIEFS

EUROPE

BULGARIA: Radio Sofia has changed some frequencies for its English broadcasts and is now heard on 15310kHz 1830-1900GMT to Africa, along with 17825kHz. The broadcast to Europe 1930-2000 is on 9700 and 11720kHz, while the transmission to North America is now carried on 11860kHz 0430-0500GMT.

VATICAN: The Vatican Radio is to continue to use the frequency of 11745kHz with English to Australia 2210-2225GMT.

ASIA

PAKISTAN: Radio Pakistan has been heard with strong signals on 21655kHz. This frequency replaces 21625kHz, and carries the World Service to the United Kingdom from 0715-1100GMT, and the English slow speed news 1100-1115GMT. Radio Pakistan has dropped 9465kHz and added 15465kHz in parallel with 11675kHz for the broadcast in English to Europe at 1700GMT, with Urdu following at 1730GMT.

TAIWAN: Following the closure of the American Forces Taiwan Network in April, some businessmen in Taipei have set up a broadcasting organisation to continue Egnlish language programs in the area. In the past AFTN has broadcast on medium- and short-wave. The new group plans to call the station "International Community Radio" and it should be heard in this part of the world.

OMAN: A verification card which gives the new schedule for Radio Oman has been received by Peter Bunn of Melbourne. The station is operating on 6175kHz 0200-0715GMT and 1400-2015 in Arabic; and on 11890kHz 0900-1100 in English and 1100-1315GMT in Arabic.

AMERICAS

BRAZIL: Radio Continental has been heard with fair signals at 0915GMT after the BBC relay station on Antigua leaves the frequency. The BBC station carries the World Service 0900-0915GMT. Radio Tupi is reported in Sweden Calling DXers as being heard on 15365kHz at around 0015GMT.

U.H.F. CB antenna strength loss is no longer a problem.

Philips introduce the battery operated Field Strength Meter which lets you measure the efficiency of your U.H.F. C.B. band antenna. F.S.M. sensitivity is such that measurements are normally made at distances greater than 20 metres from the antenna being monitored or tested. The small detachable quarter wave pick-up antenna is inserted into the INPUT socket on top of the F.S.M. If a remote antenna is required in place of the one provided the feeder from the antenna is connected to the input socket.

The F.S.M. enables day to day checks of transmitted radiated power, comparison of relative gain between antennas, and accurate measurement of radiated power to construct a polar diagram.

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PHILIPS

An important addition to your U.H.F. C.B. radio operation. For further information contact your local Philips Service Branch on the following telephone numbers, or bring your rig in for a test.

Sydney 736 1233, Newcastle 61 1631, Canberra 95 0321, Melbourne 699 2731, Hobart 28 0121, Brisbane 221 5422, Townsville 79 7422, Adelaide 223 4735, Perth 322 4653.

Specifications of the Philips U.H.F. field strength meter

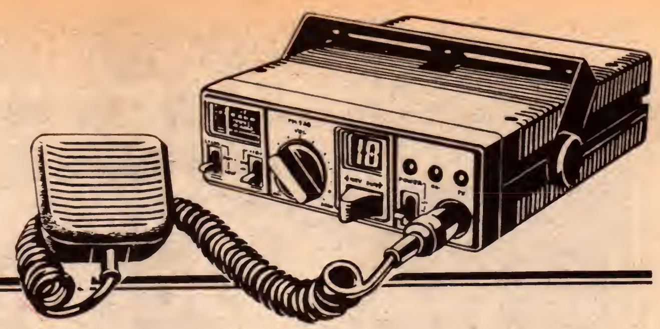
Frequency Range........477MHz + 5MHz. Input Impedance...50 Ohms.
Input Level..................−30dBm (+ 1.5dB) at maximum sensitivity.*
Scale Calibration ....−10dB to + 1dB, relative to −30dBm input.
Power Supply ....2 Standard 9V transistor radio batteries.
Battery Life ....With normal intermittent use – over 150 hours. This will be double with long life batteries.

*When the sensitivity control is set at MINIMUM, a further reduction of approximately 10dB is provided. This control is combined with the ON/OFF switch.

(Also illustrated are 2 of the new Watt meters for signal measurement)

McCANN 184.0013

The Australian CB SCENE



CB: MORE THAN ITS SHARE OF AWKWARD QUESTIONS

Is CB, on balance, a blessing or a menace to the community? Should the 27MHz band be maintained, encouraged or regulated out of existence? How can Australia square it use of 27MHz with world radio planning? Questions like these are indeed awkward.

by NEVILLE WILLIAMS

Citizens Band radio came to Australia in force a couple of years ago, amidst a tremendous barrage of publicity, and supported by a whole range of people from "progressives" through to businessmen who stood to benefit financially.

In the normal way, the authorities would almost certainly have turned CB down flat but they were faced with a virtual fait accompli — tens of thousands of CB transceivers in use and on sale, following years of neglect by successive governments. To use an old phrase, the horses were already well and truly out of the stable!

But victory turned rapidly sour for most of the campaigners. In very short order, CB users made headlines in the daily press for obscenity, larrikinism, standover tactics and other questionable activities. For the most part, the "progressives" dropped it cold. CB ceased to be the "in" thing and importers found themselves with huge stocks, which they had no hope of shifting in short order, even at almost giveaway prices. That problem is still with us.

Importers weren't the only ones to suffer. Knowing that the Government planned to close down CB on 27MHz by July 1, 1982, the Philips organisation developed their uniquely Australian UHF transceiver. Pricewise it should have been able to compete, in a booming market with quality HF imports at the then ruling figures; it was a quite different matter competing against heavily discounted 27MHz imports in a market which had turned sour.

So sour, in fact, that Philips stopped talking about CB altogether and began to woo prospective customers on the basis of "personalised two-way radio"!

This tactic had a quite unforseen repercussion: the lobby, which had long been keen to see the tariff removed from CB imports seized on it as evidence that their 27MHz transceivers and the Philips UHF transceiver were not really in competition; the tariff should therefore be removed.

Indeed, in one sense they are not in competition. If a prospective purchaser examines the propagation characteristics of the HF and the UHF bands, makes a deliberate prior choice, and then starts looking for suitable equipment, the two classes are quite distinct.

On the other hand, if the initial decision is to buy a two-way radio of some kind, subject to availability, looks and price, then the two varieties certainly are in competition. At $300-plus, Philips are already at a disadvantage selling against discounted high quality imports. With less tariff, the gap could only be greater.

Fairly obviously, the Government would like to sustain Philips' local production of a uniquely Australian product with a possible export potential. Equally, they would doubtless like to see a run-down in the stockpile of 27MHz transceivers; the sooner they are sold, the sooner will they cease to be a source of pressure to go on issuing licences for 27MHz. By the same token, if the Government is sincere about closing down 27MHz CB, it can't afford to do anything which will prompt a new wave of imports. In the long term, removal of the tariff might have just that effect.

Although questions like this persist, the authorities must at least have been thankful for a brief period of respite from the emotive side of CB. Towards the end of last year, it dropped out of the news and, while dedicated enthusiasts pursued the hobby as ever, the public at large forgot about it. It was on its way to becoming a routine activity that some followed and most ignored!

Then came a crime which was headlined in the Sydney press as a "CB Murder". Whether the headline was justified is debatable but suddenly CB was back in the news, in a most unsavoury context.

This was followed in short order by the truckies' strike with its reported dependence on CB radio to organise blockades and supplies. Initially it was seen as part of the bravado; later, as the mood of the public changed, CB became increasingly part of a mischief. Politicians, faced with a highly embarrassing situation, must surely have speculated whether it would have reached the same proportions had not the truckies been able to communicate so effectively via 27MHz CB.

It's hard to say what will happen from here on but I wouldn't be at all surprised to find that these recent events have strengthened the hand of those who would like to see 27MHz CB contained, and finally bottled up in July 1982. CB certainly can't afford a repetition of these recent events: what it needs above all else, is a low profile and improved internal discipline.

Another factor which must be borne in mind is that Australian authorities are going to find it increasingly difficult to legislate for CB, or any other service, as a purely internal matter. More than any previous conference, WARC'79 is going to put the spotlight on each country's use of spectrum space — and CB of the high-powered variety may find itself with far more critics than backers.

A curious news report preceded the recent national liberal Party conference in Perth. It nominated various major matters that would occupy the attention of the conference and, at the end of the list: CB radio ! I haven't heard whether it actually came up for discussion but, presumably someone felt that it was politically "awkward" enough to warrant inclusion on the agenda of a national conference!

L. E. CHAPMAN

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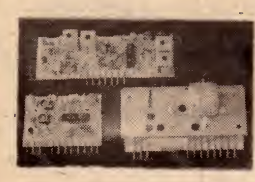

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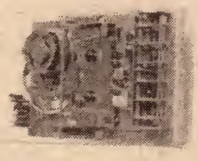

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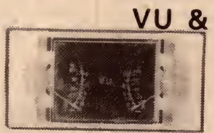

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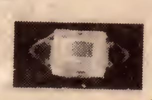

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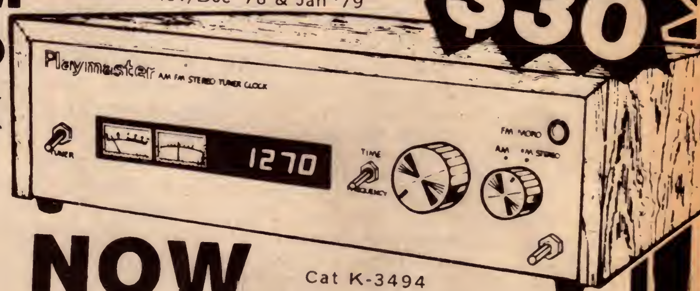

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TECHNICAL GLOSSARY — continued

CRYSTAL: A term with a variety of meanings. In the context of transmitters and receivers it usually refers to an assembly containing a critically ground wafer of quartz, which is resonant at a particular frequency. As far as the crystal is concerned, the resonance is primarily mechanical — the frequency at which it tends naturally to vibrate. When associated with electronic circuitry, the mechanical vibration can be translated into an equivalent electrical oscillation. "Crystals" cut and etched from either natural or artificially grown quartz, and mounted in appropriate holders, are widely used as the frequency determining elements in oscillators, or in filter networks.

CYCLE: In general germs, one complete round of a repetitive event. More specifically, if a train of alternating current (AC) or alternating voltage wages is displayed, one cycle is the plot between any two adjacent but exactly symmetrical points on the display. Most commonly, the start of a cycle is taken to be the point where the display crosses the median line moving upwards. Thereafter, it moves to an upper peak, back across the median line to a lower peak then back towards the median line. Where it crosses the median line the second time would be the end of the original cycle and the beginning of the next.

DC (DIRECT CURRENT): current which flows in the one direction through a circuit. The amount of current flowing may vary from instant to instant in sympathy with a signal present in the circuit but, if electrons in the circuit always flow in the one direction, the current present is said to be "direct". The current flowing from a battery to a CB transceiver is DC, as also is the current flowing thence to the collectors of the various transistors,even though they are handling signals. When the electrons in a circuit actually reverse direction, particularly in a cyclic way, the current present is said to be "alternating" current or "AC".

DC VOLTAGE: expanding the abbreviation it means literally a "direct-current voltage". This is a most awkward term, which is never used in that form. On the other hand the expressions "DC voltage" or "volts DC" enjoy very wide useage, if only for lack of a better term. The idea is that a DC voltage is one which relates to a direct current. It can be as a voltage (and current) source, or the potential which results when a direct current produces a voltage drop across a resistance. By contrast, an "AC voltage" is one which relates to an alternating current.

DELAYED AGC: (see also Automatic Gain Control). Most modern receivers incorporate a system of automatic gain control (AGC). It involves producing a control voltage which increases as the level of the input signal rises. The control voltage is applied to amplifiers in the RF and IF chain, limiting their gain and tending to keep the level of the signal at the detector fairly constant. With "simple" AGC, the system operates with even the weakest input signals and diminishes their apparent strength quite unnecessarily. With delayed AGC, the operation of the system is inhibited (or "delayed") so that it acts only upon signals above a certain minimum strength. It is a matter of signal and voltage levels; it has nothing to do with time.

New Products

Toshiba RT-8340S portable: heart of a system

Without being unduly large or heavy, the new Toshiba RT-8340S stereo radio cassette recorder manages to pack into one portable package a considerable range of entertainment facilities. Toshiba say that it is intended to slot into the market between economy (usually mono) cassette/radios and the much more expensive three-in-ones.

As distinct from the manufacturer's model number RT-8340S, the new receiver carries the name "Bombeat". The word did nothing for this reviewer, although it may have a subtle charm for the under 25's,as one of the target groups! It would certainly have the appropriate visual appeal, with its array of facilities.

As a basic radio, the RT-8340S offers normal broadcast band coverage with in-built ferrite rod antenna, plus two short-wave bands operating from a telescopic rod, which otherwise rests along the top of the cabinet. The short-wave coverage is from 2.3 to 22MHz overall, with separate MHz scales for each band. By way of additional vernier action, a small "fine tune" knob is provided.

The vertical whip antenna also serves the FM band mode and this is in full stereo, with automatic frequency control and a stereo indicator LED. As with AM, a tuning meter at the left-hand end of the dial indicates signal strength, so that accurate stereo FM reception is ensured by observing both the LED and the meter. Tested under typical user conditions on a Sydney suburban home, all the radio facilities performed as expected, with adequate gain and selectivity, good signal/noise ratio and no sign of AGC overload, even on a powerful nearby station.

The receiver is equipped with two inbuilt speakers, of nominally 120mm diameter, and twin amplifiers each rated at a nominal 3.5W.

Of special interest is a switch marked "Stereo — Wide — Space Wide". On stereo program material, pushing the switch through the latter positions produces an obvious broadening of the apparent signal source, out of all proportion to the size of the receiver itself. Without having an oportunity to see the circuit, we tip that the switch introduces high frequency cross-phasing between the channels plus, perhaps, some blending in the normal stereo position. As we said, the effect is obvious, although we also gained the impression that, on other than clean program material, it tended to highlight any noise and distortion.

The cassette facility provided in the RT-8340S is practical but fairly basic. It uses supersonic (50kHz) bias but erasure is by a multi-pole magnet, presumably to conserve current drain when operating from batteries. There is no provision for CRO2 tape and one would assume that the unit has been pre-set for conventional ferric tapes, as far as recording is concerned. Signal/noise ratio is rated at 48dB, wow and flutter at 0.2% and frequency response as 50-12,000Hz, although without dB limits.

Tape controls include the usual Play button, flanked by Rewind and Fast Forward. The last two can be partially depressed while the recorder is in Play mode, to provide a "review" and "cue" facility. There is a locking type "Pause" button which can be operated without impressing any click on the tape, and a "Record" button which is interlocked with "Play" to provide single button control. The mechanism will switch off automatically at the end of the normal play or record function, but not when fast spooling.

Recording off air is simplicity itself: merely tune the desired program and operate the "Record" function, as per the manufacturer's instructions. The program can be recorded while the receiver is playing at any desired volume, even silent. When using the in-built electret microphones, the loudspeakers are silenced automatically, to prevent acoustic feedback. On test, the record functions operated normally, although, as expected, there was some background from the motor when using the in-built microphones. In bolh modes, recording level on to the tape is controlled automatically — and effectively.

However, the RT8340S has provision for external microphones, external speakers, headphones, and an auxiliary input which can be used with any signal source having a flat frequency response. In short, apart from being a self-contained portable, the unit has provision for expansion.

Normal operation is from the AC power mains but there is provision for a 12V DC input, and for internal batteries: eight type D cells. The battery drain is about 90mA on radio and 100mA for tape play, both with the volume turned well down. Turning up the volume towards maximum produced peaks of between 500 and 700mA indicating the need for moderation in this mode, in the interest of battery life.

Recommended retail price is $229. For further details of the RT-8340S and apropriate external microphones, speakers, etc: Toshiba Aust Pty Ltd, PO Box 452, Lane Cove 2066. (W.N.W.)

Plug-in thermostat

A&R Electronics has introduced the Arlec "Thermoplug", a seif-contained plug-in thermostat unit designed to provide temperature stabilisation for domestic electric heaters. The unit plugs into a normal power outlet, and itself provides an outlet for the heater. Retailing for around $18, it incorporates 10A switching contacts and a continuously variable temperature control.

Further details from A&R Electronics at 30 Lexton Road, Box Hill, Victoria 3128.

30MHz Trio 'scope for TV

A new 30MHz dual trace oscilloscope designed with video applications in mind has been released by Trio-Kenwood Corporation in Japan. Designated the model CS-1572, the new instrument is especially suitable for servicing and maintenance of CCTV and VTR equipment. Although provided with only a single sweep generator, it has a newly developed video delayed trigger capability which offers video waveform analysis capabilities very similar to those provided by delayed sweep. Triggering can be established at any point within a TV frame, and a desired segment magnified by increasing the sweep rate. Alternate video fields can also be displayed one above the other on the dual traces.

The CS-1572 has 30MHz bandwidth at 5mV/division sensitivity and 200ns maximum sweep speed. It uses a mesh-type PDA tube for bright, high resolution displays.

Further information on the CS-1572 is available from local Trio agents Parameters Pty Ltd, 68 Alexander St, Crows Nest, NSW 2065.

Sensitised laminate

Fibreglass PCB laminate pre-coated with "Riston" negative photo resist is now available in Victoria from All Electronic Components. The laminate is available in both single and double-sided form, and in a number of sizes. Single-sided board is available in 306 x 306mm, 306 x 154mm and 154 x 154mm sizes, while double-sided board is available in 306 x 306mm and 154 x 154mm sizes.

AEC also has available liquid developer for the resist, etchant and etching kits, trays and instruction sheets for the use of these products.

Prices for the pre-coated laminate range from $2.70 for the smallest size in single sided form up to $12.70 for the larger size in double-sided form. Bottles of photo-resist developer are available at 55 cents each.

Further details from All Electronic Components at 118 Lonsdale Street, Melbourne who are the Victorian distributors for these products.

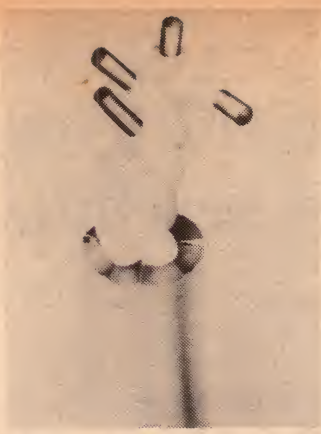
Fibre optic links

Rank Optics has released a new mains-powered duplex fibre-optic data link, designed to meet the needs of multi access computer system users. Electrical interfacing is at TTL levels, via a "D"-type connector. The fibre-optic connections are made by AMP optical connectors. At a data rate of 10M bits/second the system can be used at distances up to 1.5km with Rank fibre type 250/PCS2/08. Fibre optic cables are available already terminated with AMP connectors for use with the link units.

Further information is available from Dennis Irving, Professional Services Group, Rank Industries Australia Pty Ltd, Melbourne. Telephone (03) 29 3724.

New Products

New fire detection system



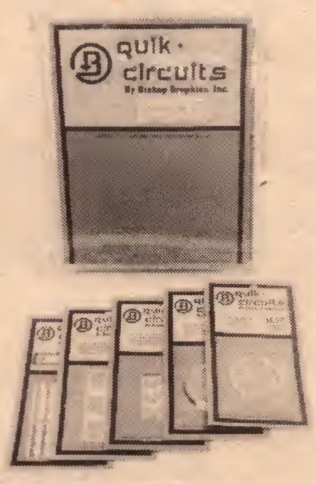
A new fire prevention system that detects fire and over-heating in tunnels, conduits, cable ducts, floor voids and other inaccessible areas has been introduced to Australia by Fire Fighting Enterprises (Aust) Ltd.

Alarmline, described as a new concept in continuous line detection in high fire risk, is already in use by BHP at Newcastle and Australian Iron And Steel at Port Kembla.

The system deploys sensitised cables which detect over-heating or fire and flash the alarm back to a control unit where appropriate action is taken. Its major uses are in mines, petrochemical plants, heavy industrial works, power stations, ocean transporters and wheat silo and conveyor complexes where the consequences of over-heating can be catastrophic and surveillance may be restricted.

For further information contact Fire Fighting Enterprises Pty Ltd, 6 Hope St, Ermington, NSW 2115.

Stick-on tracks for fast PC boards



A range of pre-etched, pressure sensitive copper mounting configurations has been released by Bishop Graphics Inc (USA). Called "Quick Circuit", the range consists of various copper patterns electro-deposited on a very thin epoxy-glass substrate. The patterns come predrilled and are designed to mate with 2.54mm grid pre-punched epoxy-glass board to allow fast, easy construction of PC boards.

The adhesive-backed patterns are also useful for the repair of existing PC boards which may have become damaged.

Also recently released by Bishop Graphics is a 200-page publication entitled "The Design & Drafting of Printed Circuits". The book is broken down into 17 chapters, and covers every aspect of PCB design.

Bishop Graphics products are distributed in Australia by Circuit Components (A/Asia) Pty Ltd, 383 Forest Road (PO Box 70), Bexley, NSW 2207.

Scientific desk calculator

Dick Smith Electronics has purchased the entire remaining stock of the Sharp "Compet 1002" LSI programmable scientific desk calculator from the manufacturer, and is offering 500-odd units at the low price of $49.50.

The calculators are mains powered and have a 10/12 digit fluorescent display. They can operate in either floating-point or scientific notation, and can store and run programs of up to 64 steps.

As supplied they provide the four basic maths functions plus trig and inverse trig functions, hyperbolic functions, common and natural logarithms and antilogarithms, exponentials, square and square root, mean and standard deviation and polar/orthogonal conversion. There is also a "pi" key, and the ability to use up to eight memory registers (which progressively reduces the program memory capacity).

The units are sturdily made, and seem very good value for money at the price quoted. You might have to be quick, though, with only 500 available.

Further details from DSE stores in most states — see their advert in this issue.

Solid-state recorders

Measuring & Control Equipment Co Pty Ltd has developed a solid-state recorder for recording field data. The recoder employs erasable read only memories (EPROMS) to store data in a non-volatile form.

The memory cartridge can be removed from the recorder and will retain recorded data without the need for backup power. The data is read out by means of a translator (playback) unit, and the memory then erased by exposure to UV light for re-use.

MACE is currently producing two versions of the recorder for hydrological and meteorological use. Enquiries to Measuring & Control Equipment Co Pty Ltd, 5 The Boulevarde, Epping 2121.

Books & Literature

Security devices

ELECTRONIC SECURITY DEVICES, by R. A. Penfold. Bernard Babani Ltd, London, 1979. Soft covers, 108 x 181mm, 102pp; many diagrams. Price in UK £1.45.

This recent addition to the Babani book range is a practical little volume on burglar alarms, smoke and gas detectors, water and temperature alarms and other security devices. The author is well-known British technical author R. A. Penfold, and he has written with the electronics enthusiast in mind.

The book begins by looking at basic switch activated burglar alarms, the elaboration of these with exit and entry delays, and basic electronic alarm tone generators. It then covers simple infra-red detectors, ultrasonic detectors and light detectors, before progressing to other types of security device such as smoke, gas, water and heat detectors.

The practical circuits given are quite simple and straightforward, but at the same time they use CMOS gates and other modern devices. The devices used are also quite readily available in Australia, which should make the book just as valuable here as in the UK.

In short, a worthwhile little book and one which should interest many security-minded hobbyists.

The review copy came direct from the publishers. (J.R.)

Op-amp experiments

THE DESIGN OF OPERATIONAL AMPLIFIER CIRCUITS WITH EXPERIMENTS, by Howard M. Berlin, Bugbook Reference Series volume 4, published by E&L Instruments Inc, Derby, Connecticut, 1977. Soft covers,. 152 x 229mm, about 200pp, many diagrams.

Another book in the E&L Instruments' '"Bugbook" series, this volume provides a basic introduction to the design and operation of op-amp circuits. As part of the treatment it describes some 35 practical experiements, designed to provide the reader with meainingful experience in using the devices and circuits involved. The author is an electrical engineer with the US Army, and also does technical writing and lecturing.

There are chapters on op-amp basics, linear amplifier circuits, differentiator and integrator circuits, voltage-current conversion, comparators and rectifiers, generators, active filters, power supply considerations, the Norton op-amp and instrumentation applications.

The approach is direct and down-to-earth, and the text concise. As a result the book seems to be very suitable as either a practical teaching guide for the serious hobbyist or a laboratory text for the college student.

The review copy came from Stewart Electronics, 33 Sunhill Road, Mt Waverley, Victoria 3149. (J.R.)

Simple projects

ELECTRONIC PROJECTS IN THE HOME, by Owen Bishop. Newnes-Butterworth, London, 1979. Soft covers, 135 x 216mm, 88pp; many illustrations. Recommended retail price $6.00.

One of a series of new Newnes books written for the electronics hobbyist, this one describes 12 small construction projects for use around the home.

Described are a moisture detector, a temperature alarm, an attention flasher, a constant-temperature enclosure for making yoghurt (!), a simple touch switch, a latching touch switch, a delay switch, a door alert, a light-operated switch, a flashing "star" for Christmas trees, a simple process timer and a power pack.

Each of the projects is fairly simple, and suitable for a beginner. They require only a small number of low-cost parts, and the parts are in most cases available in Australia as well as in the UK. The descriptions given are clearly written, and cover not only circuit operation but also physical construction. In short, just about everything a beginner would need to know in order to tackle them with confidence of success.

Not that I think the book will only be of value to the beginner — I suspect that quite a few hobbyists with years of experience behind them will find it of interest. After all, there can be lots of fun and relaxation in building up a few simple projects, particularly if they produce gadgets which are useful around the house.

At the quoted price it seems very good value for money.

The review copy came from the local office of the publisher, but by the time you read this the book should be available at most of the larger book stores. (J.R.)

INFORMATION CENTRE

PLAYMASTER TWIN 25: I have discovered a discrepancy between the description of operation and the circuit diagram. You said that a .0022uF capacitor has been fitted from the collector of T10 to 0V to reduce the open loop bandwidth from 500kHz to 40kHz to ensure stability with overall feedback applied. The capacitor however, upon inspection of the PCB, is in fact fitted between the collector of T9, a constant current source, and the 0V line.

I would appreciate it if you would let me know if this is an error or just an unpublished alteration to the circuit. In all other respects I am more than pleased with the performance. (R. A., Melton, Vic.)

● This same query was raised in a letter featured in an article on feedback from readers on the Playmaster Twin 25, featured in September 1976. While the .0022 is physically connected to the collector of T9, it is effectively connected to the collector of T10, by virtue of the 0.1uF capacitor shunting T15. So the .0022 does have the effect of rolling of the high frequency response of T10 and thus, the overall open loop bandwidth of the whole amplifier.

COORDINATED UNIVERSAL TIME: What is Coordinated Universal Time as announced by WWV? Is it just a "Yankee" version of good old Greenwich Mean Time? Several encyclopedias I have referred to fail to answer this. (D. K., Waverley, NSW.)

● Coordinated Universal Time is not a "Yankee" version of Greenwich Mean Time. Indeed, it was arrived at by world agreement and as the name suggests, it is used universally. Because the science of timekeeping is so complex any explanation relating to it must of necessity be somewhat simplified.

In recent times, time measuring techniques have been developed which are many orders more accurate than the traditional method based on observations of the earth's rotation with relation to the sun and more distant stars. There are several time scales, and the one now generally used as a prime basis exploits certain peculiarities of the atom of caesium. After centuries of observations by astronomers, the length of a year, and so a day and, finally, a second has been determined with some accuracy. To fit in with this assessment of the duration of the second, the frequency of the caesium atom has been determined as 9,192,631,770Hz.

This has become the standard of reference and it is stable to a very high order of accuracy, far beyond that of the earth's rotation, which has a number of variables. But the rotation of the earth on its axis determines our natural day and, because of the variables just mentioned, the yearly average length of the day will also vary slightly and so fall out of precise step with our new frequency standard. In order to avoid any undue accumulation of error between the standard and the average solar day, "leap" seconds are added or subtracted as required from time to time. Generally, these adjustments are made on the first day of January and sometimes at other times agreed to internationally. As a matter of interest, a leap second was added last January and virtually nobody was aware of it.

This adjusted time (by means of leap seconds), to which all civil clocks are set, is called Coordinated Universal Time and is almost the same as the older Greenwich Mean Time.

SPEAKER ENCLOSURES: I would like to design a bass reflex speaker but the information I have is not very suitable. Has "Electronics Australia" published any articles on this? Also, could you supply a formula for vented systems, and for ported systems if possible? The speaker resonance is 44Hz and the volume is 6cu. ft.

On another note, I have an idea on how to damp speaker resonance. It is as follows: (Editorial note: The writer gives a circuit of an R/L/C series network in parallel with the vice coil, plus the calculations showing how the network would shunt the voice coil at the resonant frequency.) Would this idea work? (P. S., Ipswich, Q.)

● Most of the old charts and tables to do with vented (or ported) enclosure design are suspect because they are based only on driver diameter and resonance and ignore a vital factor, namely driver "Q". It was for this reason that many vented (and ported) systems sounded unduly boomy. Furthermore, attempts to eliminate the boom by damping the vent or the enclosure itself was applying the remedy to the wrong place! The correct approach is to start with a driver which has the right diameter, resonance and "Q" so that it can be mated with a convenient enclosure to give the target results. In short, the system needs to be designed as a whole. How to go about it has been worked out by Australian engineer Neville Thiele and his approach has

been adopted worldwide and expanded upon. However, it is an engineering level exercise, which cannot readily be reduced to simple tables or charts, and applied to any over-the-counter driver. We can only suggest that you do th best you can with the driver and data you have and fiddle the performance by trial and error. If you want to damp the driver resonance, pin one or more layers of absorbent material closely over back of the housing so that the rear pressure wave has to pass through it. We would not suggest R/L/C damping across the speaker terminals.

FREQUENCY METER: I have just completed building the new 40MHz Digital Frequency Meter (File 7/F/24,25, August, September 1978) and it is operating very well. One problem, however, is that now I am not sure of the possibilities or applications of such a meter. Could you please send me ideas, particularly on connecting the input of the meter to an amateur transceiver in the best possible way. (B.W., Narooma, NSW).

● We are glad you have been successful with the Digital Frequency Meter. As you become more involved with electronics, whether it be indigital circuitry, audio, or amateur radio, you will find numerous uses for your new instrument. If you wish to measure the transmit frequency of a transmitter the easiest was is to connect a short length of wire to the centre-pin of the input socket and place it close to the antenna or dummy load of the transmitter.

NOTES & ERRATA

5V/10A (MINI-BRUTE) POWER SUPPLY (November 1977, File No 2/PS/43): The 100 ohm resistor between the bases of Tr2 and Tr3 and the output was omitted from the wiring diagram.

MAKING USE OF AUDIO INDICATORS (April 1979, File No. 1/MS/18): The AI254 cannot be substituted for the X50W12A because it is not waterproof; however, the X70W06 can be used. Also there is 15% sales tax on audio indicators; the X70W06 is $9.78 and the X50W12A is $15.99. The postage on the latter is $1.20, the mass being approximately 150 grams.

LOW COST PRINTER FOR MINI SCAMP (April 1979, File No. 2/CC/37): The author has advised that there are two errors in the message sending routine listing. At location X'10 the data field should be 06, not 00; at location X'23 the data should also be 06, in place of 0C as shown.

FASTER DUMPING AND LOADING FOR THE 2650 (April 1979, File No. 8/M/36): The hex listing on page 70 contains an error which is repeated six times. At location X'3E0A and that immediately following, the content of X'9CFE should be changed to 9D00. This should also be done at X'3E25, 3E2C, 3E39, 3E67, 3E78 and 3E9F.

If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

PHOTOSTAT COPIES: $2 per project, or $2 per part where a project spreads over multiple issues. Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

METALWORK DYELINES: Available for most projects at $2 each, showing dimensions, holes, cutouts, etc., but no wiring details.

PRINTED BOARD PATTERNS: Dyeline transparencies, actual size but of limited contrast: $2. Specify positive or negative. We do not sell PC boards.

PROJECT QUERIES: Members of our technical staff are NOT available to discuss individual projects, either in person at our office or by telephone.

REPLIES BY POST: Limited to advice concerning projects published within the past two years. Charge $2. We cannot provide lengthy answers, undertake special research or discuss design changes.

BACK NUMBERS: Available only until our stocks are exhausted. Within three months of publication, face value. Four months and older, if available, $2. Post and packing 60c per issue extra.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee, for reply in the magazine, at the discretion of the Editor.

COMMERCIAL, SURPLUS EQUIPMENT: No information can be supplied.

COMPONENTS: We do not deal in electronic components. Prices, specifications, etc., should be sought from advertisers or agents.

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

DREAM . . . from page 88

Check that the MPU address lines are all HIGH (except A0) when RST is LOW (hold down [RST]). Before trying a new MPU chip, note that any faulty device on the address bus might be holding a bus line LOW (incl. ICs 5, 6).

Assuming the actual reset circuit is operating, but CHIPOS refuses to spring to life (i.e. no 4-digit readout on screen, or no keypad response), the fault is almost certainly in EPROM or RAM, or the associated select logic. Less likely is a bad PIA, but this can be checked. If you have a good display, but no I/O response, check the PIA initialization. After resetting, PBO is HIGH, PB1-PB7 are all LOW, PA0-PA3 HIGH, and PA4-PA7 LOW. When a hex key is pressed, the PAx lines will reverse momentarily, if CHIPOS and the PIA are both operating.

If you have an acquaintance who is also constructing a DREAM-6800, see if you can arrange to borrow the MPU, RAM, EPROM, and PIA chips. One by one, substitute a chip for one of your own.

In conclusion, it must be said that, provided due care is taken in construction, the probability of success at switch-on is very high. Readers who are contemplating the project, should not be put off by the trouble-shooting section, which was included to help isolate rare, hard-to-find bugs. Problems of a minor nature should be able to be handled by enthusiasts with a moderate amount of experience, with the help of the theory-of-operation section.

(To be continued)

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CORRECTION

Futuretronics advertisement in our May issue inadvertently omitted to carry the number "3" preceding MONTHS WARRANTY.

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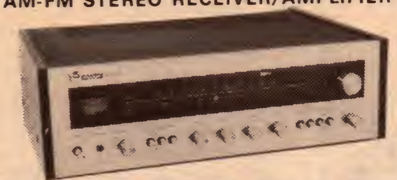

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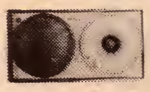

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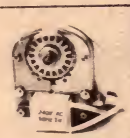

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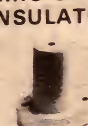

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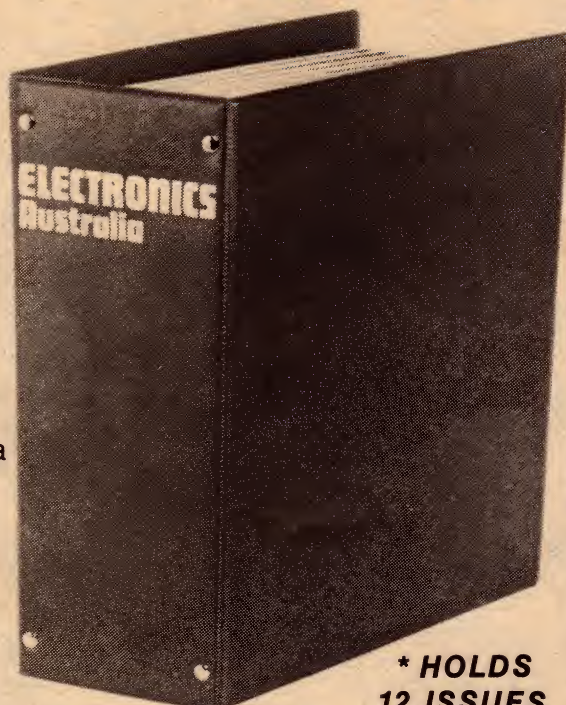

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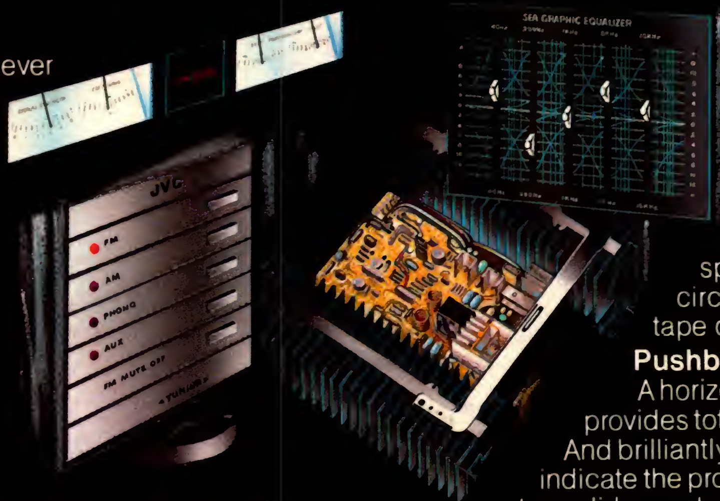

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